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OUR EVOLVING CIVILIZATION

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By GRIFFITH TAYLOR

A. GEOGRAPHY

Australia, Physiographic and Economic (4th edition).....	Oxford, 1928
A Geography of Australasia (Elementary).....	Oxford, 1914
*New South Wales.....	Melbourne, 1912
*Geographical Laboratory (for Australia).....	Sydney, 1925
*Wall Atlas of Australian Maps.....	Oxford, 1929
Australia, a Descriptive Text (Junior).....	Chicago, 1931
Geographic Laboratory for North America (3rd edition).....	Toronto, 1945
*Education for Citizen Responsibilities.....	Princeton, 1942
Australia, an Advanced Text (3rd edition).....	London and New York, 1944
Canada, an Advanced Text.....	London, 1946
Newfoundland (C.I.I.A. Series).....	Toronto, 1946
Canada's Pattern (Junior).....	(In the Press)

B. METEOROLOGY

*Climate and Weather of Australia.....	Melbourne, 1913
Australian Environment.....	(Government Printer) Melbourne, 1918
Australian Meteorology.....	Oxford, 1920
*Koeppen's World Climatology, Vol. IV.....	Berlin, 1932

C. ANTARCTICA, ETC.

With Scott—The Silver Lining.....	London, 1916
Physiography of MacMurdo Sound.....	(Nat. Hist. Mus.) London, 1922
*Hints to Scientific Travellers, Vol. IV.....	The Hague, 1926
Antarctic Adventure and Research.....	New York, 1930
*Arctic Survey.....	Toronto, 1946

D. GEOLOGY

The Archeocyathinae (Cambrian Corals).....	Adelaide, 1910
*Handbuch der Regionalen Geologie, Vol. I.....	Leipsig, 1939

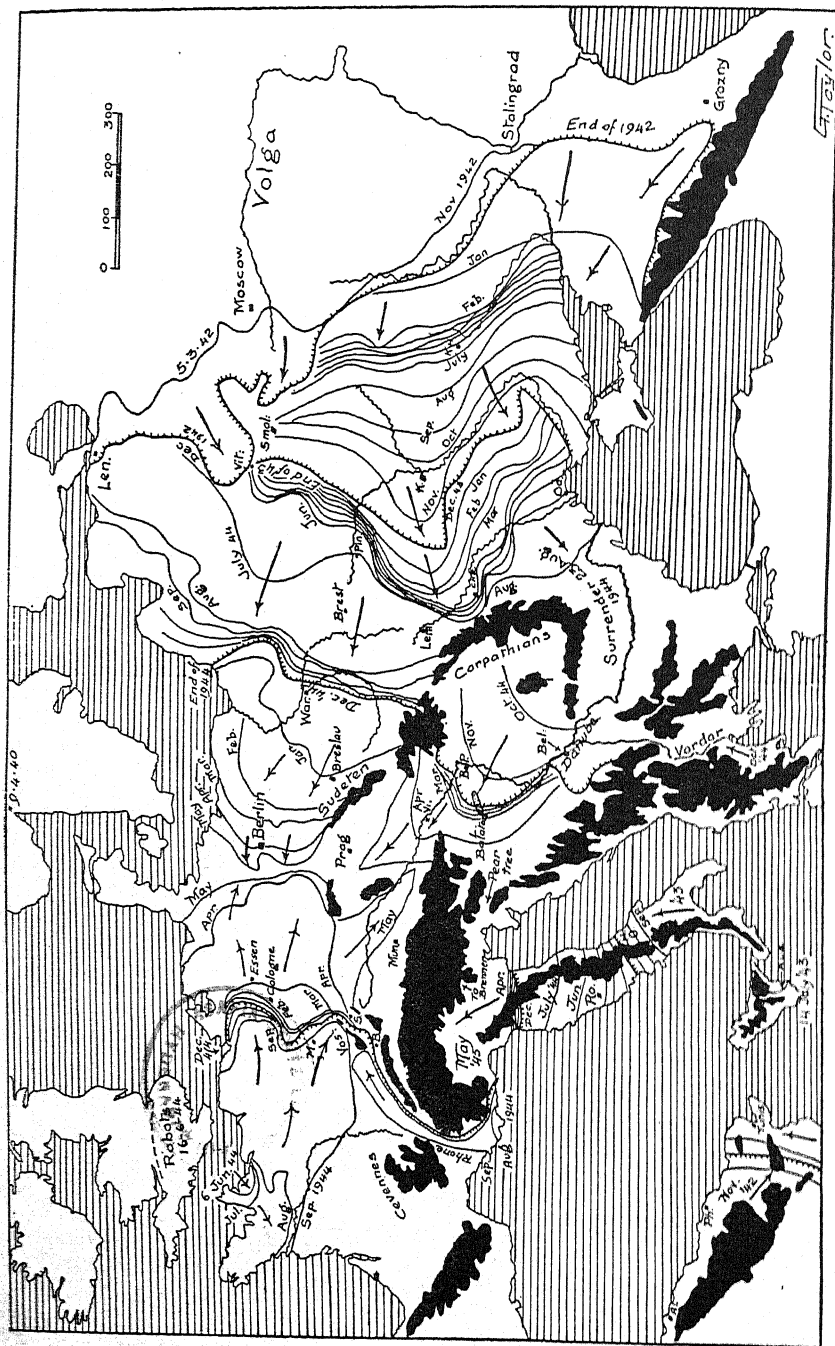
E. ETHNOLOGY AND ENVIRONMENTAL CONTROL

Environment and Race.....	Oxford, 1927
	(Japanese edition) Tokyo, 1930
	(Chinese edition) Shanghai, 1938
Atlas of Environment and Race.....	Chicago, 1933
Environment and Nation (2nd edition).....	Toronto and Chicago, 1946
Environment, Race and Migration (3rd edition).....	Toronto and Chicago, 1946
*Human Origins, an Introduction to Anthropology.....	Chicago, 1945

F. MILITARY GEOGRAPHY

Atlas of Topographic Control in Europe.....	Toronto, 1940
The New Western Front (Booklet) (C.I.I.A. Series).....	Toronto, 1942
Canada's Role in Geopolitics (Booklet) (C.I.I.A. Series).....	Toronto, 1942
Global Military Geography.....	(In the Press)

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OUR EVOLVING CIVILIZATION

AN INTRODUCTION TO GEOPACIFICS

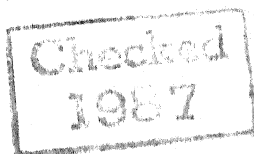
Geographical Aspects of the Path
toward World Peace

By

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President of American Geographers (A.A.G.) 1941

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FOREWORD

THE FOUNDATIONS OF THIS RESEARCH

WHEN the writer was honoured by an invitation to give the Messenger Lectures on Civilization at Cornell University, he was somewhat intimidated by the character of the subject specified. But on enquiry he found that most of his predecessors had interpreted the condition very liberally. Thus Breasted discussed archaeology, Eddington astronomy, and Millikan physics. So it seemed permissible to lecture on various aspects of geography which at all affected civilization. The present book is accordingly based on the lectures given at Cornell in April, 1944.

It is essentially a study of the effect of various environments upon man, especially in regard to the gradual changes in human conditions which characterize an advancing civilization. The field is so large, and in the aggregate so well tilled, that some apology seems advisable for adding another book on this subject. There is, however, a special point of view in which the writer may claim to have some advantage, and that is based on his unusual experience in regard to varied environments. A few words on this topic will perhaps strengthen the arguments presented in the book.

The writer belongs to a much-travelled family; for in the late seventies his father, just before marriage, was research chemist in the nitrate fields of Chile, while his mother had just made a journey from England to the interior of Queensland and back. The writer was born in London, and then went to Serbia, where he spent his early boyhood. After returning to Yorkshire for some years, he travelled to Sydney, Australia, and there received his education. It was his good fortune to be trained for research by that "Grand Old Man" of science, Sir Edgeworth David, the discoverer of the South Magnetic Pole, and a student of geology in most parts of the world.

After graduating in physics and geology, and later in mining, the writer became an instructor in geology under David for some years. He then proceeded to Cambridge University, where some of his research attracted the attention of the leading American geographer, William Morris Davis. The latter kindly invited him to join his summer journey in the Alps in 1908, and so introduced him to the principles of glacial topography and its bearing on human settlement. Since

that time the writer has spent many months tramping in Switzerland, though he pleads guilty to no mountain ascents; for he followed Davis, and like him was content to be a "valley-climber"! This grounding in glaciology led to his being chosen by Captain Scott as Senior Geologist in his 1910-13 expedition to the Antarctic. As a result he spent nearly two years studying an "Ice Age in being"; and has kept up his interest in polar affairs ever since.

During three years of post-graduate research at Cambridge the writer was engaged primarily in an abstruse field on the borders of biology. The problem was to find out whether certain Cambrian fossils (*Archeocyathinae*) from the deserts of South Australia were animal, vegetable, or mineral. A large memoir was produced in which the thesis was advanced that the fossils were the common ancestors of the corals and sponges; but sad to state, though memoirs on these fossils are still being produced, we are not yet certain as to their position. While at Cambridge the author wrote the first modern school-book on Australian geography, and this has run into four or five editions.

After returning from the Antarctic the author was attached to the Commonwealth Weather Service, where he produced a dozen memoirs and books on the climate, meteorology, and agricultural distributions of that continent. This research led to his appointment as Professor of Geography at the University of Sydney in 1920. After eight years he migrated to Chicago, and later, in 1935, took up his present position at the University of Toronto.

Some reference to field-work dealing with environmental control may be pertinent. In 1907 he took part in one of the earliest expeditions to study the coral reefs of the Great Barrier off the Queensland coast. In connection with his research in Australia he made lengthy surveys of the tropical areas in Queensland, Western Australia, and Northern Territory in 1922-4; and of the southern borders of the Australian Desert in 1919.

During 1920 he had an opportunity to journey through Sumatra and Java, and to see something of the bordering isles and Johore. In 1926 he spent a month traversing Japan, followed by another month in eastern China. In Africa he made a journey (in 1914) from Capetown to Pretoria, and again in 1938 a detailed traverse of eastern Algeria and the adjacent Sahara. On several journeys Egypt was visited, but no detailed work was done there.

In Europe the writer has tramped through most of the countries

excluding Russia and Portugal. From the fishing towns of Norway to the prehistoric sites of Malta and Mykenae, he has tried to discover how climate and topography have affected man's history.

His migration to Chicago in 1928 was determined by a wish to study the developments of a civilization in a second "new" continent. Forty of the United States have been traversed, and the writer has benefited by the innumerable scientific studies that have been produced by American scholars on these areas. In 1930 he carried out a little mild exploration in the Andes of South America, and it is believed that the resulting chart of the Rio Frio valley is more accurate than those previously published. Since his arrival in Canada he has wandered widely throughout the Dominion and Newfoundland making traverses of practically all sections, including one north of the Arctic Circle.

It will be seen that by 1930 he had made surveys in each of the seven continents; and these journeys have been of the greatest advantage in regard to the subject of this study. While it is true that most travellers are not scientific observers, and so make few deductions of value to science, it is also true that those numerous writers "who stick to their desks and never go to see" are at a considerable disadvantage in a study such as that offered in this volume; for it depends essentially on geographic distributions and correlations. In conclusion the writer hopes that this book, dealing with "Geographical Aspects of the Path toward World Peace" may be found to be somewhat of an antidote to the perverted geography of German geopolitics. Hence its sub-title of "Geopacifics." It is also his pleasant duty to thank several friends, notably Professor Ward (Cornell) and Professor Innis (Toronto), for a number of emendations of the manuscript.

GRIFFITH TAYLOR

The University of Toronto
November 28, 1944.

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PART I

WORLD PLAN: CLIMATIC CONTROL: RACIAL DIFFERENTIATION

*"Whoever aspires to understand human history as a whole,
must at least acquire the map-making, map-reading faculty at
the start."—MARETT.*

CHAPTER 1

THE WORLD PATTERN AND ITS EFFECTS ON EVOLUTION

INTRODUCTION

WHEN one considers the large number of volumes which have been published on the subject of Civilization, it might seem difficult to justify the production of another in this very well tilled field. However, as a geographer who has always been primarily interested in *Environmental Control*, it seemed to me that by isolating this aspect of the problem, one might hope to present a connected view of the way in which nature has "controlled" (or as many geographers prefer to say "conditioned") man's activities during his slow evolution from ape-man to citizen of the world at peace.

I may premise my remarks by admitting that professional geographers are divided into two camps: the Environmentalists and the Possibilists. The former camp is much the less popular, for it holds to the belief that environmental control is not only obvious, but the most important factor in general geographic distribution. The fashionable Possibilist party stands far to the right, and believes that man is almost all-powerful, and is free to choose which of many possible paths he will follow in exploiting the bounties of nature. As in so many other cases, the point of view largely depends on the way in which a man has been educated. If he has spent twenty-five years investigating the semi-arid lands of Australia, and thereafter transfers himself to the semi-arctic lands of Canada (which is the writer's experience), he is much more likely to be impressed by the paramount powers of the harsh environment, than if he has been trained (like most American geographers) in one of the richest areas of the earth—the eastern portion of the United States.

It will be obvious that only one aspect of the progress of civilization can be considered in this series of chapters, i.e., the environmental factor. There are, of course, many other aspects, certainly much more often traversed in literature, and, in many people's minds, of more direct significance than the rather subtle action of the environment. However, as a geographer who has devoted most of his research to this study, the writer hopes to throw light on many episodes in the slow

unfolding of the history of mankind, which may be in part missed by the historian, anthropologist, or sociologist.

As has often been pointed out, geography is a liaison subject, linking such studies of the *natural* environment as geology, botany, astronomy, physics, etc., to the *human* disciplines of history, sociology, economics, and the like. Partly for this reason, geography is of especial importance in this stage of our intellectual development. I cannot do better than quote the opinion of the British publicist Lord Samuel on this matter, which is somewhat as follows: "Science in modern times can be trusted to look after material things, but philosophy and religion are still in the melting pot. The frontier where science and philosophy meet, and where the conclusions of one are handed across to be the premises of the other, should be taken as the vital centre in the wide realm of thought." In so far as these ideas can be applied to geography, such a philosophy is the aim of this book.

The teachings of geology, of physics, and of ecology are first to be discussed in so far as they help us to understand the surroundings of primitive man. His racial differentiation and dispersion are to be explained rather readily by reference to these basal physical studies. Thereafter we shall consider the sub-division of the broader racial groups into the smaller national groups. We shall next see something of the material background of the development of cultural and linguistic divisions. From this stage we shall pass to the consideration of still smaller groups engaged in building up the early towns and centres of a more advanced type of civilization. Inevitably linked with this spread of material culture, we shall find a spread of less ponderable factors in our life, for religions and philosophies are amenable to study by the geographical approach.

Indeed much of history may be looked upon as consisting of a series of strata one above the other in the time scale. Each stratum represents the product of the interaction of the whole environment upon the people of that particular time. Until relatively recent times this way of looking at history was little studied; for the obvious reason that very little was known of the environments of the past. An illustration of this sort of approach to history is afforded by the recent book *An Historical Geography of England*¹ which seems to be as fairly classed a history as a geography.

¹An *Historical Geography of England before A.D. 1800*; fourteen studies, edited by H. C. Darby, Cambridge, 1936.

There is one other way of looking at environment which the writer has rarely seen discussed. Civilization, and in the long run human evolution, are due to the action of innumerable stimuli upon the various folk concerned. These stimuli consist of all kinds of agents, some educational, some emotional, some material. Of these stimuli the environmental type is by no means the least. To quote an example: the readers of this book are very different from Neandertal man; they are also very different, we may believe, from our descendants some fifty thousand years hence. But we ourselves are the living links in this chain of human beings; and it is our material environment which is probably the major factor in determining just how this slow evolution shall take place. Thus a study of environmental control would seem to be well worth the attention of every cultured citizen.

In the present world crisis it is natural to be much interested in discussions having to do in some degree with the world war. It should be unnecessary to point out in how many fields the teachings of geography are directly helpful. Military geography is a very practical side of our discipline. Strategy and tactics are inevitably based on problems of supply and communication, and are linked with the distributions of land and sea, and of mountain and plain. Some of the broader aspects of this sort of environmental control, as affecting the recent military operations, will be discussed in a later section. It is perhaps in the field of propaganda that cultural geography plays a valued role. Such topics as the Nordic superiority, or the fallacy of the "Aryan race" can be more readily explained and exploded by illustrative charts than in any other fashion. Such has been the aim of the present writer ever since the Nazi party machine started to distribute the half-truths touching on economics, sociology, and anthropology, which are so large a portion of their propaganda. Here again we see an illustration of geography's position between the material and the philosophic fields. It is precisely here, as Samuel has pointed out, that the ordinary scheme of education is sadly wanting.

Finally, all students of world politics know that the philosophy of the Nazis in considerable measure depends on the data collected and systematized by Haushofer and his school in the journal *Zeitschrift für Geopolitik*. Much of Hitler's *Mein Kampf* is said to be drawn from Haushofer's teaching by way of his disciple, Hess. *Geopolitik* may be described as specialized geographical pleading, glorifying the power and resources of the German Reich, and expounding the doctrine of

Lebensraum. It teaches more or less directly that the world's destiny is to fall under the control of the *Herrenvolk* who occupy the German Reich: that this state must inevitably dominate Europe, the Old World, and finally the globe itself.

It would seem a worthy goal, demanding, however, the labours of many writers, to place together the salient geographical data which have a bearing on the gradual evolution of our world to a condition of relative peace. Writers engaged on such tasks should examine the main causes of the cleavages which separate race from race, nation from nation, and culture-group from culture-group. They should stress the cases where race has actually amalgamated with race, and where such a process seems to be proceeding with some show of ultimate success. They should examine the factors which tend to unite cultural groups into a strong nation. Equally they should study why certain nations have dwindled in power, or at times died out. They should emphasize the fact, as the writer sees it, that nationality is but a passing phase in the creation of a world civilization. In effect, as he has written elsewhere, they should look forward to a time when internationalism will inter nationalism in the limbo of early stages of our world history.

The writer has ventured to suggest that this type of study—largely the cultural geography which has engaged his attention for over twenty years—should be given the name of *Geopacifics*. In some sort it may be considered as an antidote to those biased publications of Haushofer and his fellow geographers, which are now known under the heading of *Geopolitics*.

THE WORLD PLAN AND ITS EFFECTS

The reader who wishes to obtain a knowledge of the various environments of man is likely at first to be bewildered by their apparently infinite variety. However, it will be found that when the principles determining the environments in one continent are mastered, those for the other five (excluding Antarctica) will be found to be much the same. We may compare the great land areas to the four suits in a pack of cards: the arrangement in one suit is repeated in the others. In effect, there is a world plan. It is well worth while to devote some time to an understanding of this definite pattern; for the evolution of the mammals, of man, and of his civilization, is in no small degree conditioned by this definite plan.

Two facts about the world are familiar to every reader. The first is that the earth is not a sphere, but an oblate spheroid; approaching an orange in shape. The second fact generally known is that most of the continents are rather broad in the north, and taper greatly to the south, forming elongated peninsulas best shown in Africa and South America. We can explain how these definite characteristics arose in terms of the "tetrahedral theory" which was first suggested by Lowthian Green about 1877.

The flattening of the polar portions of the globe is due to the rotation of the earth about its axis. It can readily be demonstrated by a simple apparatus in the physics laboratory. But of somewhat the same magnitude is the slight departure of the shape of the globe towards that of a pyramid or tetrahedron. To understand this we must know

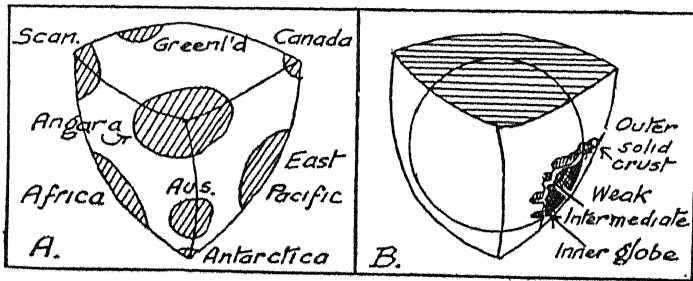


FIGURE 1.—Structure of the globe, exaggerating the pyramidal (tetrahedral) shape. At A are suggested the resistant "Shields." At B are the two outer layers (solid crust and weak intermediate layer), and the inner contracting globe.

a little as to the constitution of the outer portions of the globe. It is believed to consist of three layers—so far as our present theory is concerned. The outer layer is the crust of the earth, only a dozen miles or so thick, which consists largely of acid rocks (like granite), or of the sediments developed from such light-weight rocks. Then below this is another layer of heated rocks, often somewhat more basic in character, with more iron and lime in them than the granites. These are subject to considerable pressure, but they are so highly heated that under conditions of crustal movement they yield, and flow like plastic materials. Then below this weak layer (the asthenosphere) is the main mass of the heavy, highly-heated interior rocks, which contract as a whole, but do not melt or flow, owing to the enormous pressure to which they are subjected. These layers are indicated in Fig. 1 at B.

It seems probable that every 150 million years or so, the earth undergoes a period of widespread contraction and mountain-building. In the simplest language (which necessarily cannot be a complete explanation) the main central portion of the globe contracts slightly. The outer crust is already solidified, and resists crumpling to some extent. However, the intermediate weaker layer yields; and the outer solid crust accommodates itself as best it can to the lesser volume produced by the contraction of the main portion of the globe. It has been suggested by Hobbs that the regular geometrical figure which would develop in the outer crustal layer under these conditions would be the tetrahedron. The diagrams in Fig. 1 will make the theory readily understandable.

Before considering how closely the actual pattern of the earth corroborates Green's hypothesis, we must consider another of the basic principles involved in a study of the earth's shape. We find that the most resistant portions of the crust are the great level or undulating expanses of ancient rock which are known as *Shields*. These have resisted earth-folding right through the latter part of the geological record, say for the last 450 million years. The striking elevations of the earth are almost wholly made up of portions of the crust developed between these large shield areas; in fact mountain-building is closely linked with movements of the great shields, as we shall see very shortly.

It is found that these shields in general occur near the four projecting corners of our tetrahedral globe (Fig. 1 at A) or along the edges nearby. They are indeed the main skeletal elements of each continent, the solid nuclei against which the rest of the continent has gradually accumulated.

A familiar object may be used to illustrate how the shields are involved in the processes of mountain-building. Let us take a rubber balloon, inflate it, and cover certain oval patches on its surface with a light coat of varnish. Such a treatment is suggested in Fig. 1 at A. Now we slightly deflate the balloon, and we shall find that the resistant varnished areas remain relatively smooth, while the intervening weaker portions of the rubber are puckered into many folds and ridges. This is much what happens on the earth's surface during those periods of crustal change which we call mountain-building. Some of the most striking of these elongated crustal puckers, which we call mountains, are represented by the lines AB and CD in Fig. 2. The fold AB can be traced running between the resistant shields of Angara on the north, and Africa and Australia on the south, if we compare Fig. 1 at A and

Fig. 2. In the same way the fold in the crust forming the Rockies and Andes is represented by CD in Fig. 2. It represents the weaker parts of the crust puckered between the resistant Canadian Shield and Brazilian Shield on the eastern side, and the floor of the eastern Pacific on the western side. (It should be noted that this last shield is the sole example that does not form part of a continent, but of this more anon.)

We have now learnt that the earth's crust is made up of strong units called shields, and of weaker portions, which in late geological time have rather readily yielded, thus giving rise to the great mountains of today. Hence it is clear that the poets who speak of the "age-long

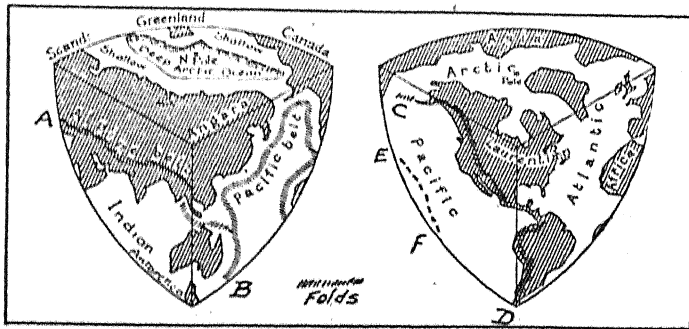


FIGURE 2.—Two views of the tetrahedral world, showing by broken lines the young fold-mountains.

hills" are scientifically inaccurate. They should, properly speaking, eulogize the reverend age and unyielding character of the rather low flat shields of the earth!

Since a good deal of this book will be concerned with the effect of mountains upon climate and upon man, it will be time well spent to learn how the mountains of the various continents have been produced, in greater detail than is given in the foregoing paragraphs.

Where are the high "young" mountains of the world today? In general they surround the Pacific Ocean (Fig. 3 at left), and then, branching off from the East Indies, build another great series of crustal folds through Burma to the Himalayas and so via Persia and the Anatolian plateau to the Balkans, Alps, etc., of Europe. Most of the remaining so-called mountains of the world (e.g., the Appalachians) are merely the worn-down stumps of bygone young mountains, which

have been elevated *en masse* (during the last period of mountain-building) to the condition of rather low, flattened plateaux, etc.

It follows from the preceding paragraphs that each of the seven continents consists of three major regions. The shield lies on the Atlantic (or Indian) Ocean side, and the young mountains on the Pacific side (except in Africa). There is a less definite area between the two, which usually takes on the shape of a broad "crustal trough" (or syncline). This is definitely the pattern in North America; and each of these topographic types has its special economic characteristics, which we may briefly examine, since they have a great influence on human affairs.

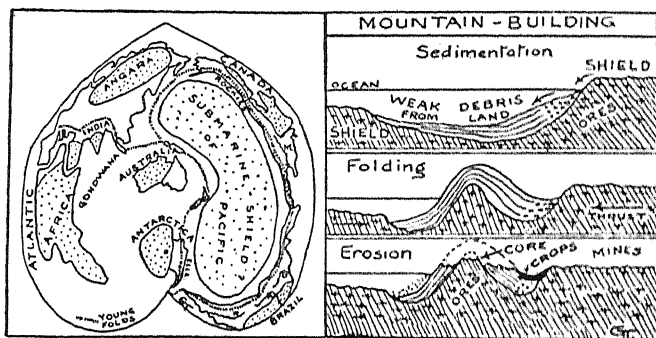


FIGURE 3 (left).—The resistant shields (dotted) and the young mountains (broken lines). (Right).—The three processes of mountain-building.

The three main processes involved in mountain-building are sketched in the adjacent diagram (Fig. 3 at right) and are worthy of our attention. In the upper figure we see the cross-section of a continent—say of North America about fifty million years ago. In the east is the ancient resistant shield* of Canada, while to the west is a broad Cretaceous² sea, which is gradually being filled with sand, silt, etc., during the lengthy process of sedimentation. It is suggested in this figure that the floor of the Pacific to the west consists also of a submarine shield.

In the middle section in Fig. 3 the period of earth contraction has begun during the early portion of the great Tertiary period of time. The weaker soft layers laid down in the shallow waters near the Canadian

²The Cretaceous period was about fifty million years ago. See Fig. 6.

Shield are now being buckled up to great heights, perhaps twenty or thirty thousand feet above the sea. This constitutes the second stage in the development of mountains, that of the folding. Most of the young mountains of the world developed during the Tertiary period, say during the last twenty or thirty million years. This very vital period in the world's evolution is often known as the "Alpine Storm"; since it was the storm (affecting the crust of the earth) which produced, among other mountains, the Alps of Europe.

The third period in the development of present-day mountains is sketched in the lower section (Fig. 3). In most cases the mountains were raised ten or twenty million years ago, though the process was by no means synchronized in all parts affected by the Tertiary folding.

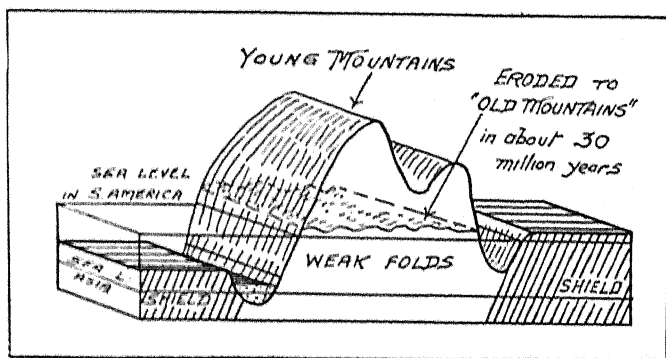


FIGURE 3a.—The production of young mountains and their wearing-down to old mountains.

At any rate in most parts of the world there has been ample time for great erosion to have taken place. This necessarily removed vast thicknesses of the young mountains. Since the velocity of stream erosion depends largely on the slope of the surface, it follows that the steeper higher portions vanished long before the lower gentler slopes were much affected. The debris torn from the mountain tops is naturally deposited in the adjacent hollows; and this in time will lead to an overloading here, which may in turn lead to an upward buckling when the next great crustal storm is ready to develop.

It should be clear from the two later sections given in Fig. 3 that the thickest deposits of soil will be below the flanks of the young mountains in the broad shallow "downfold" which usually develops

here. Here also the main rivers of the region will take their courses, and here also will be the best agricultural lands. In part this explains the valuable croplands which occupy the region between the Rockies and the Canadian Shield, i.e., in the north the Canadian Prairies, and in the south the states of Nebraska, Iowa, etc., in the vicinity of the Missouri River. Moreover, the enormous erosion lays bare the older rocks of the crust, especially near the core of the uplifted ridges or "anticlines." It is in such positions (as well as in the ancient rocks of the shield) that metal-bearing veins are most likely to occur. Furthermore, in gently warped domes bordering the main folding (not shown in the section), there are suitable collecting spaces for the rock-oil which may seep upward from deeper strata rich in the remains of long-buried organic matter.

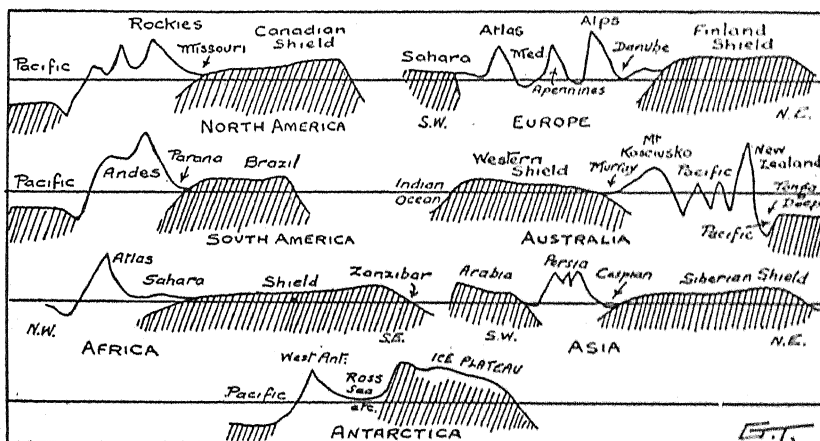


FIGURE 4.—Sections across the seven continents to show their similar structure, i.e., young mountains compressed between two shields.

In Fig. 4 cross-sections of all seven continents are shown somewhat diagrammatically. The same general pattern is apparent in all. In North America, for instance, during the Alpine Storm the weaker sediments laid down in a great wide trough (or geosyncline) in Cretaceous times were compressed between the Canadian Shield on the east and the resistant floor of the eastern Pacific Ocean on the west. Thus were produced the Rockies, with the Missouri flowing in the slight downfold between fold and shield as indicated. In Europe we see somewhat the same kind of development. In this case a great wide sea (much larger

than the Mediterranean and extending far to the north and east), known as the "Tethys Sea," received the silts and clays. When the Alpine Storm was at its height these weak sediments were buckled into several high ridges, of which three are given in the section. There is no doubt that the Finland (or Russian) Shield moved closer to the African Shield, both acting as jaws of a gigantic vice to compress these weak sediments.

In South America the evolution of the continent was much the same; and there is little need to emphasize the similarity between its structure and that of North America. In Australia we have an interesting variation in that it is the west which contains the continental shield; for in this area the Pacific with its submarine shield, of course lies to the east (Fig. 3, left). Many of the main folds pass well to the east of the continent, through New Zealand, etc. Australia, indeed, only contains a series of low, rather isolated warps and plateaux along its east coast. There is no continuous "Dividing Range," though such is shown on many out-of-date maps.

Africa is not quite after the general pattern, since so much of the continent consists of a giant shield. Only in the north-west, in the so-called Barbary States, are there young mountains which together build up the Atlas Mountains. They leave Africa near Tunis, and pass across the Mediterranean Sea into Sicily, to link with the Apennines of Europe (Fig. 79). In Asia the Alpine Storm affected two wide belts of crust. One of these extended across the centre of the continent, and has produced the highest mountains on earth, the Himalayas. This elevated portion of the crust extends westward through Persia to join the European Alps near the Black Sea (Fig. 2), and eastward to meet the Pacific border-folds, which run from New Zealand northward through the East Indies to Japan and the Aleutian Islands. Our section, given in Fig. 4, runs from near Aden across the Arabian Shield (really part of the great African Shield); it then passes across the downfold of the Persian Gulf, the elevated young mountains of Persia, the downfold of the Caspian Sea, and so reaches the resistant masses of the Siberian (or Angara) Shield.

We know very little about the internal structure of the Antarctic continent. It occupies about five and a half million square miles, so that it is much bigger than Europe or Australia (Fig. 3 at left). The main mass of the continent (East Antarctica), which includes the South Pole at an elevation of 10,000 feet, seems to be a level-bedded shield like the Russian Shield. It is bordered by a colossal scarp running for 1,200 miles

or so alongside the Ross Sea and Ross Ice Shelf. On the other side of the continent we have the similar Weddell Sea, but the lands south of this sea constitute the sole large area left for future explorers. For many years the present writer³ has believed that a broad downfold links the Ross and Weddell Seas, no doubt completely covered with land ice. Ellesworth and Byrd in recent years have discovered high mountains, which show that the region called West Antarctica is an extension of the Andean young mountains, and this is suggested in our section in Fig. 4.

We are now ready to return to a consideration of the tetrahedral world. It seems possible, as suggested earlier, that the solid crust, upon contraction of the interior basic sphere, took on the form of a tetrahedron, "which of all regular figures has the minimum volume for a given surface." No satisfactory reason seems to have been offered why the axis of rotation should pass through the centre of the Arctic Ocean and the centre of the greatest protuberance on the earth, i.e., the Antarctic continent. We have seen that the resistant shields form the corners and edges of the pyramid (Fig. 1). It is obvious that the mobile oceans will collect on the flat faces of the pyramid, since these are nearer to the centre of gravity than the edges. It was the resulting antipodal arrangement—whereby every continent was opposed by an ocean—which aroused Green's attention in 1877. At that date no one knew what was at the North or South Poles. But to satisfy the tetrahedral shape it was necessary that there should be a deep ocean at the North Pole—as Nansen discovered in 1894-5; and a large continent at the South Pole—as Scott demonstrated in 1903 (Fig. 2). These later discoveries certainly strengthen the validity of the theory as to the tetrahedral shape of the earth, though scientists are not yet agreed as to how this came about.

As regards the effects of continental masses on climate and on the paths of dispersion of plants, animals, and man, we may sum up our knowledge of the world plan in the phrase: a broad zone of land in the vicinity of latitude 50° N. with three tapering tongues or peninsulas projecting from the heart-land of Asia. These peninsulas are Eur-Africa projecting to the south-west, Asia-Australia projecting to the south-east, and the two Americas projecting to the north-east (Fig. 5). The vital importance of this arrangement of lands, in determining much of the evolution of animals and man, will become evident in the next chapter.

³See the writer's book *Antarctic Adventure and Research*, New York, 1930.

Interlocking with this system of lands is a similar group of water areas. There is a continuous ocean (sometimes known as the Antarctic Ocean) in latitudes 50° and 60° S., with three long tongues of water (the Atlantic, Pacific, and Indian Oceans) extending to the north.

Exceptions to the Rule. There is one feature in the world plan which does not agree with the tetrahedral theory at all closely. The Pacific Ocean is so large that no continent is opposite (or antipodal) to much of its western portion. We shall find that a great deal of this part of the Ocean is strongly corrugated in the form of crustal wrinkles, which

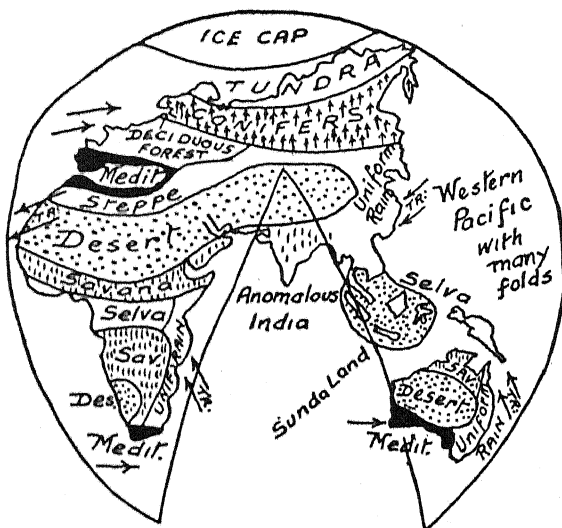


FIGURE 5.—Sketch to show the tri-peninsular world, with the nine climatic zones on each side of the Equator.

are apparent at the surface in long chains of "festoon" islands. Possibly this part of the Ocean (to the west of the line *EF* in Fig. 2) should be linked with Australasia as regards structural character. Such a transfer somewhat improves the antipodal relation of continents and oceans. It also makes the area of the deep stable oceans equal to that of the continents plus the folded western Pacific floor.

Before we leave this question of the world plan, there is one aspect of great interest as regards evolution as a whole and man's evolution in particular. It has often been stated that man is the creation of the remarkably stimulating environmental changes which marked the close

of Tertiary times. This period of ten or twenty million years has exhibited so many changes of land and sea, and of climate and environment generally, that the more plastic the type of plant and animal the better it has been able to survive. For instance, certain genera of the apes have had a rather high degree of plasticity, and so have survived by adapting themselves to changing conditions. Indeed, evolution very largely consists in adapting oneself to changing conditions. Have there

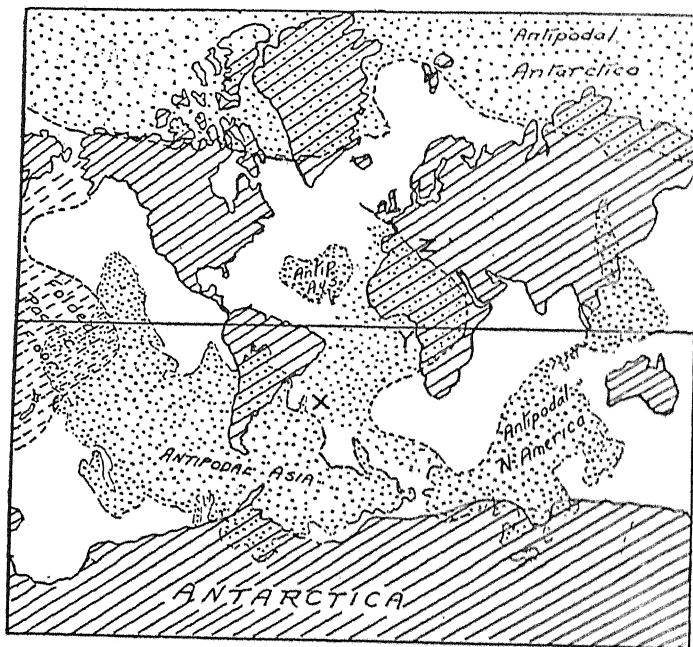


FIGURE 5a.—The continents are antipodal to the oceans, as shown by reversing the land areas. The folded floor of the western Pacific is treated as land.

been other similar periods of great environmental change exhibited in our 500 million years of geological record? Have they, in turn, been followed by similar rapid developments of new creatures or new types of plants? To these questions we may answer that there have been at least four such "catastrophic periods" in the record, and in each case a great burst of evolutionary activity marked such periods. It is now a quarter of a century since the writer first drew attention to the longest of the biological cycles of which there seems to be any evidence. Since

the evidence still seems significant, it may well be considered quite briefly.

It was my good fortune to be associated as a young teacher with the veteran geologist Sir Edgeworth David at the University of Sydney. He was just investigating the evidence for a Pleistocene glaciation on the summit of the highest plateau in Australia. Not every geologist was willing to accept his conclusions, which, however, have been amply confirmed in the last forty years. Moreover, about this time, fossil ice ages dating back 150 million years (to Permian times) were discovered in south-east Australia near Melbourne and Newcastle; while others far

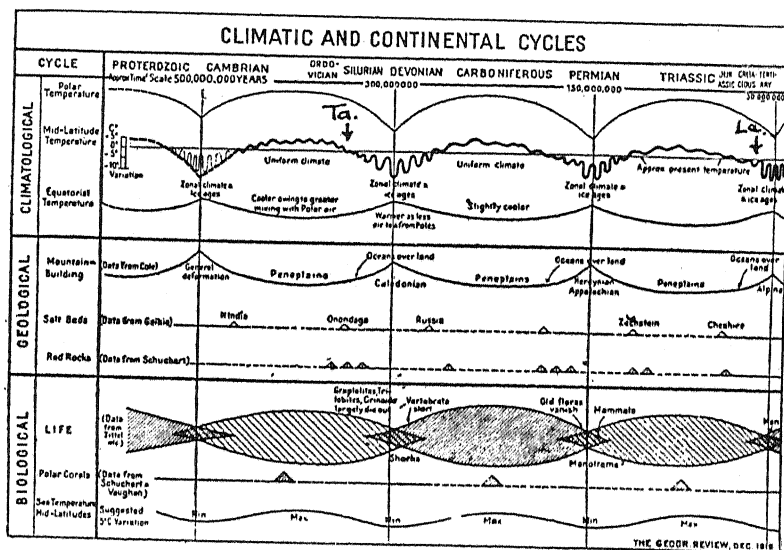


FIGURE 6.—The geological record for the last 500 million years, showing four catastrophic cycles, each 150 million years long. (From *Environment and Race*.)

older (dating back 450 million years to the Cambrian period) were found to be widespread in South Australia. Thus the interest in changing climates and changing mountain topography was widely spread in Australia. Somewhat later, about 1915, the new technique of determining the actual age of deposits by means of radioactive minerals was elaborated. Now for the first time it was possible to learn if these catastrophic periods were repeated at somewhat regular intervals.

In 1919 I published the graphs here reproduced as Fig. 6, which

show the geological record for 500 million years. We need only dwell on three of the horizontal lines therein depicted. The second line suggests that the temperatures of mid-latitudes have fluctuated in a very remarkable fashion. For the major portion of the geological record (shown along the top of the graph) the climate in our latitudes has been fairly uniform throughout the year. We may note, for instance, in these periods that most of the trees do not show seasonal changes in growth. But as four periods in the record, namely: Cambrian (450 million years ago); Devonian (300 million); Permian (150 million); and the latter part of the Tertiary (the last 20 million years), there were very marked seasonal changes in the temperature through the year, as well as the still greater fluctuations which we call the recurring ice ages.

These major changes in the character of the climate are accompanied by tremendous changes in the distribution of land and sea. Our present era is quite definitely a time of giant mountains and large continents. It seems likely that if we could watch the earth's surface throughout most of the four or five hundred million years of the geological record (i.e., back to Precambrian times, when the record becomes very confused) we should in general find that the world exhibited much smaller and flatter continents, worn down to the low, undulating type of landscape which the geographer calls a *Peneplain*.

In earlier paragraphs the writer has described the periods of mountain-building which marked late Tertiary times (i.e., the "Alpine Storm"). Geologists can prove that similar mountain building (the Appalachian or "Armorican Storm") occurred on a world-wide scale in Permian times; in Devonian times there was the Acadian or "Caledonian Storm"; while in early Cambrian times occurred the "Killarney Storm."

In 1919 I suggested that these "catastrophic periods" had taken place at intervals of about 150 million years; and though it is too soon to claim this as a veritable cycle in world affairs, it furnishes a very valuable clue to the major periods of biological evolution.

In the following table I prefix, before my own deductions of dates (as given in 1919) the currently accepted dates, as published by Schuchert and Dunbar.⁴ The oldest dates are at the bottom.

⁴See (in *Outline of Historical Geology*, Charles Schuchert and Carl Dunbar, 3rd ed., New York, London, 1937) Fig. 22, "The Duration of Geologic Time," modified after David White.

THE GEOLOGICAL RECORD, STRESSING CYCLES

Schuchert Times	Geologic Ages	Years Ago	Structure	Climate	Life Changes
I. About 190 million years	End of Tertiary	Last 5 million	Catastrophic (Alpine Storm)	Ice ages	Man in Miocene?
	Early Tertiary Mesozoic	30 million 30 to 150 million	Some mountains Low peneplains	Uniform Uniform	
II. About 140 million years	Late Permian	150 million	Catastrophic (Appalachian Storm)	Ice ages	Mammals
	Carboniferous	200 to 300 million	Peneplains	Uniform	
III. About 160 million years	Early Devonian	300 million	Catastrophic (Caledonian Storm)	Ice ages	Vertebrates
	Silurian, etc.	400 million	Peneplains	Uniform	
IV.	Early Cambrian	450 million	Catastrophic (Killarney Storm)	Icc ages	Animals develop shells
	Precambrian	Very imperfect geological record			

This table suggests what every biologist accepts as a fairly general law, that catastrophic changes in environment produce great changes in the plant and animal life. Just before Cambrian times we find that animals had begun to produce calcareous or horny armour for the first time, and they have utilized this great biological discovery ever since. It is true that examples of every one of the modern biological classes, except the vertebrates, were already present in Precambrian times. But as we go back of the Cambrian, the rocks show more and more violent changes, which are often proven by the highly contorted characters of the layers.

As regards the vertebrate ancestors of man, it looks as if the Caledonian Storm were instrumental in producing the first *Vertebrates*, which are akin to the sharks. The next period of catastrophism (in Permian times) produced the new development of the *Mammals* (probably from Theriodont reptiles during late Permian times). The Alpine Storm of the last few million years, as stated, is responsible for the evolution of *Man* himself. The main mountain-building epochs are

suggested in Fig. 6 in the fourth horizontal line. The main stages in the evolution of the vertebrates, etc., are indicated in the seventh line in the same diagram.

Exceptions to the Rule. It must be conceded that there are data which do not fit into this picture as closely as one could wish. For instance there was a considerable period of mountain-building which is dated by Schuchert and Dunbar about 380 million years ago. It produced mountains in the Taconic region of New England (T'a. in Fig. 6), and the mountains of this period have been recognized elsewhere. Possibly it ushered in the Caledonian Storm. So also there was a storm of considerable significance in the north-west United States, which produced coastal ranges at the very beginning of Tertiary times. This is called the Laramide Storm (La. in Fig. 6). But one may fairly consider that this was the very beginning of the Alpine Storm, which continued throughout most of Tertiary times, though its most striking phenomena were perhaps in Miocene times about ten million years ago. After all the whole of Tertiary time (say fifty or sixty million years) is only equivalent to a single Paleozoic era, such as the Ordovician or Cambrian.

It will have been noticed that these four catastrophic periods have been accompanied in part by recurring ice ages, of the same types as the four ice ages which marked the last million years of the Tertiary period. These later major climatic changes seem to have occurred at intervals of about 200,000 years (during several periods of about a million years), for there is some evidence of similar glacials and interglacials in the three earlier catastrophic periods.

It must be noticed, however, that the ice ages were by no means linked with many of the major periods of elevation; so that we cannot say that the ice age is merely due to a large portion of the crust having been lifted far above sea level. This is not the place to discuss the causes of an ice age. A new theory is developed almost every year! The writer propounded a theory of his own in 1919, involving cyclical interference by a now far-distant stellar visitor. If any reader is interested he may refer to this theory,⁵ which strives to link the long cycle of 150 million years, shown by the catastrophic storms, with the short cycles of 200,000 years perhaps exhibited by the recurring ice ages.

⁵See "Climatic Cycles and Evolution" (*Geographical Review*, Dec., 1919, p. 316).

It is perhaps some corroboration of these suggestions that a Cornell biologist, W. T. Forbes, advanced somewhat the same ideas (a dozen years later) in his paper "Great Glacial Cycles,"^a where, however, he adopted a slightly longer period of 200 million years for the catastrophic cycle.

^aScience, vol. LXXIV, 1931, p. 294.

CHAPTER 2

CLIMATES OF THE WORLD, CLIMATIC CONTROL AND EVOLUTION

CLIMATIC CHANGES AND CLIMATIC CYCLES

IN the preceding chapter we have learnt that remarkable changes have occurred in the distribution of land and sea, as well as in the arrangement of mountains and plains. These take place rather slowly, so that ten million years may be needed to build a range of mountains, and the land may be rising at one end of a major range while subsidence and erosion are lowering the elevations in a distant part of the same crustal ridge. In relatively recent times, the climatic changes are very much more apparent than the topographic changes. Indeed, in all lands but the equatorial, climatic change is, of course, the rule today. In hot lands the change is usually from wet to dry seasons, while in temperate lands we have very marked changes of temperature as well as rainy seasons, which in general occur in the warmer months. In polar lands the temperature changes are extreme, especially in winter, but the amount of precipitation is relatively small.

If we consider human history so far as we know it, the effects of topographic changes are not very pronounced. Violent earthquakes and volcanic eruptions have produced great havoc in very localized areas. Krakatoa, the island near Java which blew up in August, 1883, was perhaps the most striking phenomenon of recent times. About 36,000 folk were killed by the tidal waves, and the volcanic explosions were heard 3,000 miles to the west. But much more significant are the slow changes which are still continuing in areas like the St. Lawrence and the Baltic Sea. Here the coasts have risen several hundred feet since the ice vanished, i.e., in the last 20,000 years. Indeed, the elevation is due to the "elastic" crust slowly coming into equilibrium now that the immense load of the glacial ice cap has melted away.

We are all aware that an ice age controlled life in a large part of northern temperate lands during the recent ice ages. The layman has not, however, a very clear idea of the mechanism of this ice age. It is well to realize that there is an actual ice age within three miles of us even in the middle of summer. It is, of course, vertically overhead

(Fig. 7); and as the summer wanes this "ice-age layer" descends. In December the isotherm of 32° F. (which bounds the icy region) runs west-east through Cincinnati, and for a few months each year our latitudes are actually experiencing an ice age.

The logical way to consider the onset of an ice age is to think that the wedge of warm air (which enables the crops to grow in our latitudes, and which is thrust north from the tropics during the summer, and withdrawn during the winter) does not advance as far north as usual in an ice age. Or in other words, the cold layer, which nowadays

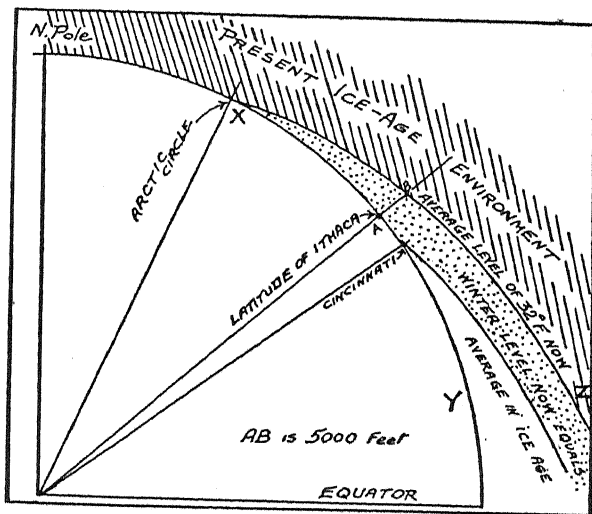


FIGURE 7.—Diagram showing the wedge of warm air XYZ which prevents our experiencing an ice age. The dotted area has a temporary ice age each winter.

descends to the earth only in winter, did not rise in the ice ages into the higher layers of the atmosphere, but affected the surface environment the year round. This former descent of the ice-age layer is very clearly seen in most temperate mountain regions, where the evidences of bygone ice ages (in the form of moraines, cirque valleys, etc.) are often to be seen at a level of 4,000 feet below the present snow-line. Above the line of "permanent snow," we may fairly say that a district is still in the condition of an ice age.

Of course to produce a gigantic ice cap such as formerly covered North America down to the Missouri and Ohio Rivers (which in part

represent the thaw-water channels at the front of the ice cap) there were considerable changes in the snowfall also, but we need not consider these details for the moment. The chief thing to remember is that no tremendous change in our general environment is needed to bring about an ice age. Probably a drop in the average annual temperature of only 10° or 12° would be sufficient.

Most climatologists today accept the view that the climate is always changing to a lesser or greater degree. As Huntington pointed out long ago, these changes are of a fluctuating character, and never proceed for very long periods in one direction. For instance, there seems little doubt that the changes in the abundance of sunspots—which clearly represent great changes in the character of the outer heated envelope of the sun—occur at regular intervals of about eleven years. These

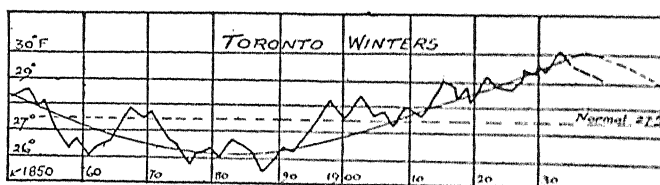


FIGURE 8.—The rising temperatures during the period 1880-1930 are illustrated in this graph of winter temperatures at Toronto since 1850. Note, for each year, the average for the last ten years is used. (From A. J. Connor.) The thin line shows the "smoothed" curve for the period.

sunspot changes seem to be definitely associated with changes in the general heat supply reaching the earth. They must affect the year-to-year changes in our climate, though it is by no means easy to show how the very complex pattern of the earth climates is changed. In recent years there is a tendency to say that a longer twenty-two year cycle or a forty-four year cycle (based on the shorter eleven-year cycle) agrees fairly well with widespread droughts, cold spells, floods, and the like.

If we consider the temperatures in Toronto during the time of our detailed record, A. J. Connor¹ has shown that the winter temperatures have on the average been rising since 1885 (Fig. 8). In that decade the winters exhibited temperatures around $25\frac{1}{2}^{\circ}$, but by 1936 they fluctuated around $29\frac{1}{2}^{\circ}$. This is a real change of 4° F. in the short period of

¹C. F. Brooks, A. J. Connor, and others, *Climatic Maps of North America*, Cambridge, Mass., 1936.

half a century. We may be sure that the average winter temperatures will start to decrease fairly soon, but our record is too short to enable us to say if we are here dealing with a recurring cycle or not. The thin curved line in Fig. 8 seems to suggest that this temporary change is part of a hundred-year cycle.

We have just considered examples of major cycles in the form of the four ice ages, whose period is about 200,000 years. We have also referred to the cycle of sunspots only eleven years long. Many other cycles have been proposed of both longer and shorter periods, and there can be no doubt that they have been of great importance in changing the environment of the earth to greater or less degrees, and so very materially affecting the evolution of organic creatures. If we consider the phenomena which have affected the most people within the last century or so, we realize that droughts and floods have led to as much movements of peoples as have wars or conquests. The potato famine in Ireland in the forties of the last century led to vast emigration to America. The floods of northern China contributed greatly to the migration of a million Chinese into Manchuria. Within the last decade the continued "dry" cycle in the "Dust-bowl" of the United States and Saskatchewan has adversely affected thousands of settlers in the inland plains of North America. No one can deny the vast importance of climatic changes on a far grander scale which must have occurred during the 8,000 years of civilized history of which we have some record.

THE MAJOR CLIMATIC REGIONS OF THE WORLD

Before we deal with the interesting topic of climatic change from year to year, let us consider the pattern of the climates of the earth in regard to our structural world plan. There are many classifications of climate, the best known being that of Koeppen, which is capable of including an almost infinite number of minor sub-divisions. For our purpose the simplest and most useful is that based on the natural vegetation, which enables us to divide the land areas into some nine or ten distinct groups. These classes are exhibited twice in each of the three land areas (or peninsulas) which have been described in an earlier section.

In Fig. 5 these nine climatic classes are inserted in position on the Eur-African "peninsula" of the tri-peninsular world plan. In the north is the ice-cap region, partly, of course, consisting of pack ice floating

on the Arctic Ocean. Next to it comes the *tundra* or "Barren Grounds." These consist of undulating plains covered with mosses and flowers in the short hot summer, but lying under snow for the long winter. In somewhat warmer lands, where the July temperatures rise above 50° F., we find the great belt of coniferous forests (*taiga*) which occupy the northern parts of Russia and Siberia.

In temperate lands there is a great difference in the rainfall on the western and eastern coastlands. In the cooler lands the surface winds are moving from west to east, so that the western coasts are wet, while the eastern coasts are usually much drier. In the warmer temperate lands the dominant winds are the trade winds, which are from the east in both northern and southern hemispheres. Hence in these latitudes the east coasts are wet and the west coasts are dry. Indeed, this is one of the reasons why deserts are found alongside the oceans in these positions. Reverting to Fig. 5 we find that on the west coast of the Old World in Europe, in the wetter, cooler part, there is a belt of *deciduous forests* (oaks, beeches, etc.). Just to the south the climate changes to the very interesting *Mediterranean* type; in this latter class the rains fall in the winter and there is a hot, dry summer. As a result we find an environment marked by tussock grasses, bulbs, and shrubs, with the large trees confined to the valleys and better watered areas only.

Where the off-shore trade winds blow, as in north-west Africa, we find a zone of *steppe* lands south of the Mediterranean lands, with sparse grasses and scattered shrubs. This passes imperceptibly into veritable desert, when the rainfall falls below ten inches in the year. On the eastern shore of the New World, however, the trade winds are on-shore, and help to produce good rains in a broad belt near the sea. This rain is fairly uniform through the year, and gives rise to a beautiful type of mixed forest, with such trees as magnolia, etc., which are familiar to residents in the southern states of the Union. The same type of forest is found in southern China.

Finally, on the equatorial side of the desert zone, we gradually reach a belt with fairly good rains in the summer, say about sixteen inches a year. This gives rise to tussocky grasslands which are known as *savanna*. They grade into the *savanna woodlands*, which consist of large scattered trees with much grass beneath. Where the rainfall approaches seventy or eighty inches a year we find the *selva* or tropical jungle. This is found only near the Equator, under conditions which ensure rain in every month of the year. Since these areas are very hot

throughout the year, the result is a very exuberant plant life. We should, however, guard against the common idea that this indicates good soils, or promises great things for future settlement.

Since the temperature and rainfall controls are much the same south of the Equator as they are to the north, it is clear that the above nine climatic classes will be repeated in reverse order in the Southern Hemisphere. It has, however, been pointed out that the lands peter out to the south, and indeed this is indicated in the rough diagram in Fig. 5. We can see that selva, savana, desert, east coast uniform-rain region (with forests), and the grass and shrub flora of Mediterranean type are repeated in southern Africa. In South America the lands reach so far south that the deciduous forest is also present, but this is not the case in South Africa or Australia.

Much the same climatic zones are found in North America, and are repeated in inverse order south of the Equator. In the third of the "peninsulas" of the world plan (that comprising east Asia and Australasia), the lands are so broken that the classes are not very regular. This incomplete peninsula is sketched on the right of Fig. 5. During the Pleistocene, when the ice caps removed so much water from the oceans, there was a large sub-continent, called "Sunda Land," between Asia and Australia; but this land was drowned when the ice caps melted at the close of the ice ages. As mentioned previously the innumerable festoon islands forming Micronesia and western Polynesia are the emerged summits of submarine fold-ridges. It has long been suggested that the continental areas of Australia and Asia might well be extended some considerable distance to the east to include this "yielding" portion of the Pacific floor. However, this aspect of the Pacific structure is rather academic, and need not concern us further. The appropriate climatic zones are seen to be well displayed in Australia, and closely parallel those in South Africa.

MAN AND CLIMATIC OPTIMA

It will be readily understood that this problem of climatic control is a very complex one, since we have to do with variable present-day climates throughout the year at any one place, and also with variable climates throughout the ages (for we are concerned with the history of several thousand years). We may consider the problem of present-day climates first of all, and then learn something of the marked

changes which have occurred through the millenia in which early civilization was evolving.

Obviously various environments are suited to different types of life. Huntington has given evidence that the optimum temperatures for the best mental work by folk of our type are by no means the same as those which seem to be conducive to the best physical work. The former optimum (for mental work) seems to occur when the natural temperature is around 40° F., while the physical optimum is near 64° F. If we mark out the two belts which include these isotherms on the earth's surface (one to the north and the other to the south of the Equator) we obtain the map shown in Fig. 9.

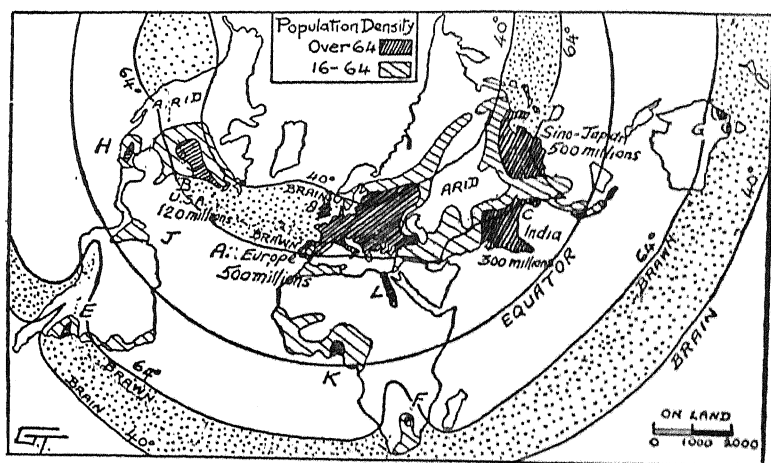


FIGURE 9.—The optimum regions for vigorous human development are suggested by the two dotted belts between isotherms 40° F. and 64° F. Closely ruled areas are those with a population density over sixty-four per square mile.

In the Northern Hemisphere this belt is quite broad and includes a very large proportion of land. In the Southern Hemisphere only a small portion of the southern continents is included, in the vicinity of Buenos Aires, Johannesburg, and Sydney respectively. There is little doubt in the writer's mind that these six areas will always be the habitats of the most progressive peoples. The northern belt is interrupted by areas which have too little rainfall to be very satisfactory for large populations, especially in western America and in the interior

of Asia. Thus there are three large regions of optimum settlement and three small regions, the former being (a) southern Canada and eastern United States; (b) most of Europe (except the north and south coastlands) together with a considerable portion of western Siberia; and (c) Manchuria, north China, and Japan. The southern areas (around Buenos Aires, Johannesburg, and Sydney) have already been indicated.

Obviously, if our population is more concerned with physical than with mental work, a great deal of the zone on the equatorial side of the isotherm of 60° F. is satisfactory. This in part explains the fact that early civilizations were in general situated nearer the 64° isotherm than that for 40° F. But this very important point will be discussed in more detail later on.

We are apt to think that a people lives in the regions which are best suited to it. Most folk would assume that hot, moist climates are essential to the well-being of the majority of the Negro peoples. Dr. C. A. Mills in his recent very stimulating book *Climate Makes the Man*² holds quite strongly that life in the tropics is a grave handicap. In his own words, "In the tropics a third of the earth's population is held captive by the difficulty of losing bodily heat." He quotes a striking if homely example, by instancing the high death-rate on a pig farm in very hot weather. Unless the pigs can wallow in cool, moist mud they cannot lose the necessary body heat, and soon die of heat stroke. Human beings react in somewhat the same way. Man is a complex heat-engine consisting of innumerable muscular cells. As in all heat-engines only a small part, say one-third, of the fuel supply (i.e., food in man) is used to produce energy. The remainder is wasted; but must be dissipated from the body by radiation, etc. This is easily managed in cool "vigorous" climates. It is only fair to state that Dr. Mills believes that a resident who accommodates himself to the slower tempo of the tropics may live longer than in more stimulating climates—provided he does not die of the numerous dangerous diseases of the tropics! Another interesting example deals with the work in a Philippine factory, where central cooling was adopted. Thirty per cent more work was done by the Filipino women when the temperature was kept at 65° F., instead of at the normal temperature some ten or fifteen degrees higher.

Another way of looking at climate is to classify the different types according to range of temperature throughout the year. This range is

²New York, London, 1942.

proportionate to two factors: (a) distance from the ocean; (b) distance from the Equator. The largest ranges, accordingly, are found where these two factors both operate, i.e., towards the north centre of the main continental land masses. There is one such area of high range of temperature (amounting to 80° F.) extending along the Mackenzie River in Canada. But almost the whole of eastern Siberia has a bigger difference than 80°, i.e., between the July and December monthly average temperatures. These, then, are emphatically the regions where animals and primitive man are likely to receive the greatest physical stimuli, since they have to accommodate themselves to such tremendous variations in the environment during every single year. Of course, such changes are often so great that they repel organisms rather than help them to evolve. To instance an extreme example, the onset of an ice age is always marked by a great movement of animals away from the oncoming cold conditions. Indeed, large numbers of plants and animals find the changing conditions too drastic and gradually die out. Hence it should be clearly understood that the general centre of widespread evolution will not be the same as the region of greatest temperature range, but may well be on the warmer side of this central area. Such is indeed the case as we shall see shortly, for it is precisely in this area in south central Asia that the famous biologist W. D. Matthew has placed the cradleland of most of the higher mammals.

We may now briefly consider evidences of changing climate during the early days of man's evolution. Lack of space prevents more than a brief survey of this very complex question, and I propose to confine my discussion to certain changes in western Europe and north Africa. The non-geographical reader knows of the ice ages, but naturally has no clear idea of the changes during the last 10,000 years or so. An examination of the bygone forests of north-west Europe gives us a fairly clear picture of the chief changes during the last few millenia. We must remember that there have also been considerable changes in the elevations of the lands around the North Sea during these periods.

RECENT CLIMATIC CHANGES IN EGYPT AND WESTERN EUROPE

It is, of course, impossible to discuss all the changes in climate and topography which took place in the last 10,000 years, and so affected the arrival of the modern types of races in Europe. We know that the ice ages slowly waned, and that the front of the ice melted; but, of course, no ice actually moved to the north, though the ice front

retreated. It should be obvious that as the cold conditions moved to the north, the belts of vegetation also slowly moved northwards in unison. This movement was perhaps as much as 700 miles, for we know that the temperature increased by $12^{\circ}\text{F}.$ ³

During the ice-age conditions of some 40,000 years ago, no part of Europe would be very attractive to peoples who liked a warm, rather dry, climate. It seems certain that only Paleolithic peoples lived in Europe, often enough in caves during these inclement times. But there is little doubt that a much more advanced race was living in north

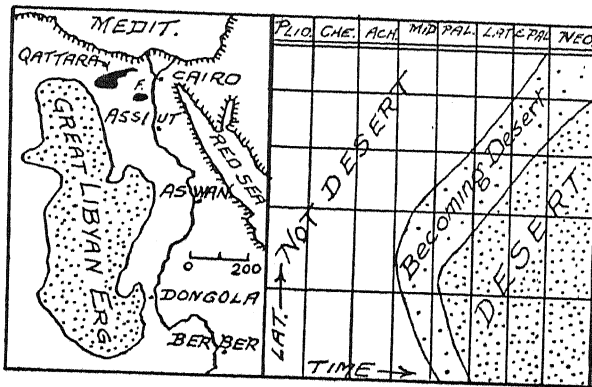


FIGURE 10.—Changes in climate in Egypt since Pliocene times. The chart at the right shows the oncoming desert during the Paleolithic period, whose stages are shown at the top. F. is the Fayum Depression. (Based on K. Sandford.)

Africa during the last ice age. All the indications point to these folk being the ancestors of the Mediterranean peoples of Europe. As time elapsed, Europe became warmer and much more attractive, while north Africa gradually changed to semi-desert conditions. This is suggested by the accompanying diagram which is based on data gathered in Egypt by K. Sandford.⁴

In Fig. 10 at the left is shown a map of Egypt emphasizing the largest patch of moving dunes in the Sahara. It is this Erg, which is

³As suggested earlier on page 23 this change in temperature would be brought about by a shift of the isothermal layers through $12^{\circ}\text{F}.$ of latitude, assuming that the slope of the isothermal layers (shown in Fig. 7) had the same inclination as it has today. See the discussion on temperature changes in my *Australian Meteorology*, Oxford, 1920, chap. vi.

⁴"Problems of the Nile Valley" (*Geographical Review*, vol. xxvi, Jan., 1936).

readily reached from Cairo, which has given an entirely wrong impression of the general character of the Sahara. Most of the latter is covered with sparse vegetation, and only one-sixth is "living dune" (Erg) of the type shown in Fig. 10. Moreover, Sandford has shown that these desert conditions of today only gradually ruined north Africa. In the latitude of Berber the desert conditions began in middle Paleolithic times (Fig. 10 at right), while in the latitude of Assiut they only started with the beginning of Neolithic times. To the north of Cairo the littoral is still in semi-desert conditions, as the chart on the right suggests. Changes of this sort affecting man in Paleolithic times undoubtedly drove out many, and perhaps most of the inhabitants of the northern littoral of Africa. They naturally moved northwards more or less in accord with the belts of vegetation to which they were accustomed; which, of course, moved north also. To this period, at the close of Paleolithic times, we assign the incoming of the numerous peoples who introduced many of the Neolithic forms of culture (about 8,000 or 10,000 B.C.) into southern Europe. They were somewhat slighter folk than the earlier Europeans, with rather narrow heads and wavy hair. They are the ancestors of the Mediterranean races of today, who inhabit the Mediterranean coasts of Europe, as well as much of the Atlantic coast, including the western portions of the British Isles.

Obviously during this shift of vegetation belts to the north, the second portion of Europe to become at all attractive would be the central portion near the Alps and the Danube valley. It seems probable that this was soon occupied by brachyceph (i.e., broad-headed) Alpine tribes moving westward from Asia. No doubt some of these folk had arrived in earlier interglacials, but the main influx was about 8,000 B.C. Later still, after the north of Europe had gradually changed from ice cap to tundra, and then to steppe, pine and oak forest, the hordes of Proto-Nordics arrived from southern Siberia. They used the northern of the three corridors suggested in the generalized map given as Fig. 18. The way in which these three main races are distributed over the continent of Europe will be described in the next chapter.

The following table⁵ gives the climatic changes for north-west Europe in the last 12,000 years. The oldest data are at the bottom of the table, and the times are linked with the marked changes in the Baltic Sea, with the climatic periods, the forest changes, and the human cultural ages. (Mesolithic is often included in Neolithic.)

⁵H. C. Bibby, *Evolution of Man and his Culture*, London, 1938.

Date	Baltic Sea	Climate	Forests	Archaeological Periods
A.D. 1,000	As now	Sub-Atlantic (cool)	Beech Hornbeam Spruce	Historic time
0				Iron age
B.C. 1,000	As now	Sub-Boreal (cool)	Spruce	Bronze age
2,000	Littorina Sea		Lime Oak	
3,000		Atlantic (warm)	Elm	End of Neolithic
4,000	Littorina Sea		Alder	
5,000			Hazel	
6,000	Ancylus Lake	Boreal (cool)		
7,000		Pre-Boreal (cold)	Pine	
8,000	Yoldia Sea	Sub-Arctic	Birch	Start of Mesolithic
9,000		Arctic	Willow	End of Paleolithic
10,000	Ice		Ice	

Data from various sources are collated in this table, but some of the most interesting are derived from Swedish peat bogs. When deposits from these deep layers of peat are examined, it is found that the acidic water has preserved the microscopic pollen grains of the various trees. The proportion of pollens varies a good deal in the different layers. At the bottom are the pollens from trees which grew in north-west Europe after the ice age, as the climate slowly increased in warmth. Thus in these lowest layers, much pollen from birch and pine is recovered. Somewhat higher are the layers produced during the warmest period (i.e., the Atlantic), where oak, elm, and hazel are found to be much more important. Near the surface of the bog, beech and spruce become increasingly abundant.

In a valuable paper^a Dr. C. E. P. Brooks charts these varying distributions of the common trees in the north-west of Europe during the last 10,000 years. He points out that the birch and willow are cold-loving trees, and their general predominance implies a sub-Arctic climate.

^a"Post-Glacial Climates and the Forests of Europe" (*Quarterly Journal of the Meteorological Society*, Oct. 1934).

However, these trees were very common in northern England about 8,000 B.C. (Fig. 11). At this time pine, which likes a warmer summer than birch, was the dominant tree on the continent and in the south of England. In the next few millenia the climate changed considerably, with warm, sunny summers and rather cold winters. This boreal climate (Fig. 11) suits the hazel, which largely replaced the pine as a dominant tree on the continent as well as in England. The mixed oak type of

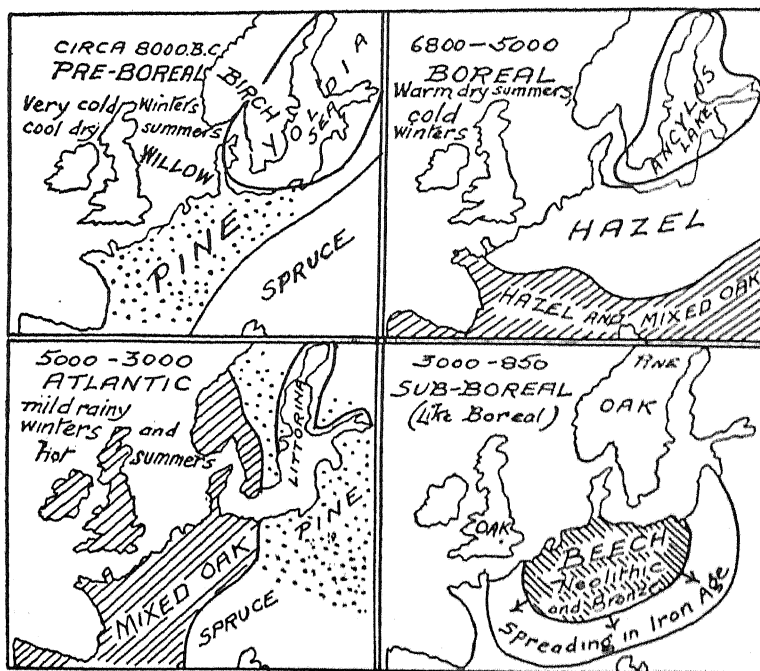


FIGURE 11.—Changing environment during the last 10,000 years in north-west Europe. Climates, forests, and Baltic topography are collated in somewhat simplified maps, based on C. E. P. Brooks.

forest needs a rather warmer climate than the boreal with more rain, though dry spells in summer do not harm this forest. Since this is rather characteristic of the Atlantic type of weather, we find that such a forest is dominant during the period around 4,000 B.C. Finally the beech is sensitive to spring frosts, and thrives best in a rainy climate of moderately oceanic type. In the sub-boreal, which on the whole is rather dry, the beech began to spread eastward across south-eastern

Europe, and in the following warmer sub-Atlantic period extended north into south Sweden. Its area has, however, since been reduced.

On the four maps shown in Fig. 11 some indication is also given of the marked topographic changes during these important periods of human history. About 8,000 B.C. the Arctic Sea was in communication with the Baltic by a broad strait in the vicinity of Leningrad. In these cold salty waters there flourished the mollusc *Yoldia*, from which the sea has been named. As the ice vanished in the north, the elastic crust rose somewhat, and shut off the *Yoldia* Sea both to north and south. Thus was formed the Ancylus Lake, so named from a common freshwater shell. Later again, the sea flooded the Ancylus Lake, and the Baltic was somewhat larger than it is now. This larger area is called the *Littorina* Sea, from a periwinkle shell found in the deposits of that date.

CLIMATIC CHANGE AND ITS EFFECT ON HUMAN MIGRATION

The chronology of the last 20,000 years has been worked out (with the nearest approach to accuracy) in Scandinavia by the geologist De Geer. During the ice ages silts were laid down in the glacial lakes in this region with great regularity. It is quite possible to find deposits where each annual layer can be counted over a period of many centuries. Collating all the data, De Geer has been able to find how long a time has elapsed since the ice front was in Denmark, in south Sweden, and in north Sweden. Today the ice front is represented only by a number of stagnant "*Jokul*," i.e., bun-shaped masses of ice up to ten miles across. These are found only on the summit of the Norwegian plateau at heights of about 5,000 feet.

As mentioned elsewhere in this volume, the retreat of the ice front was accompanied by a northward movement of the main forest belts of northern Europe. These moved about 800 miles in a period of about 20,000 years, or about 200 feet a year on the average. The actual process consisted of the spread of seedlings on the northern side, and the dying out of the trees on the southern side of each forest belt.

What is extremely interesting in the Scandinavian research is that we are able to link these forest spreads with the corresponding spreads of primitive man. Generalizing somewhat, we can say that Neolithic man entered the Baltic region about 9,000 B.C. when the fir forest was replacing the grassy steppes; while Bronze Age man accompanied the spread of the oak forest, and Iron Age man migrated to some extent

with the beech forest. If we dig down in a deep bog in the north of Germany, we may find some six strata represented in the deposits under the bog. At the top are beech relics with remains of Iron Age man.

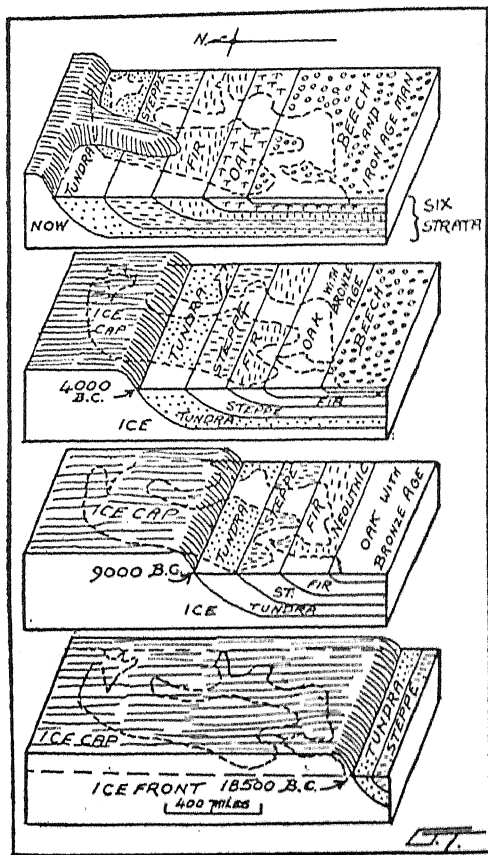


FIGURE 12.—Generalized block diagrams showing the northward march of the ice front, of the vegetation zones, and of primitive man in Scandinavia, since the close of the Wurm ice age. The front of each diagram shows the strata in section. (Based on research by De Geer, Peake, Fleure, etc.)

Below these are acorns and fossil oak leaves, which in turn cover remains of fir forests. Beneath these are fossil plants together with grassland animals indicating a steppe flora. At the very bottom we may find striated rocks, which show that ice formerly covered the area.

All these varied data are combined in the four block diagrams sketched in Fig. 12, though they are naturally somewhat generalized. In the bottom diagram in Fig. 12 we see the Scandinavian region as it appeared about 18,000 B.C. We are looking to the east, and at that time the whole area was covered with ice, while tundra and steppe conditions characterized north Germany. In the sketch just above, are shown the conditions about 9,000 B.C., when the fir forest was invading Denmark. At this time Neolithic man made his appearance, as is shown in the diagram. By 4,000 B.C. the ice front was situated in northern Norway, and the oak forest covered much of Denmark. In the topmost sketch we see the environment of this region as it is today. Only a few relics of the ice are now to be found on the plateau, but they are joined together in the sketch.

This is probably one of the most valuable diagrams we can offer to explain the way in which climatic change has affected the movements of vegetation and human beings. They are necessarily linked, especially in the earlier days of man's evolution. The same type of environmental control during prehistoric times is to be expected in every other part of cool temperate latitudes; and it is because many anthropologists and prehistorians do not understand the mechanism of the changing environments that their conclusions are not as accurate as they might be.

As regards temperate North America it is usually assumed that the last major ice age passed away about 30,000 years ago. Here, as in Europe, there have been four major ice ages separated by warmer interglacials. It seems highly likely that these represent the same periods as those named by Penck after the moraines he investigated near Munich. Thus the European names, Wurm, Riss, Mindel, and Gunz are to be equated with the names used in America, Wisconsin, Iowan, Illinoian, and Kansan. In both continents the total ice-age period is assumed to be about 800,000 years, and this, of course, takes us far back of the times of civilized man.⁷

Having seen how the distribution of population during a period of human evolution and of changing climate has been largely determined by climatic controls, let us apply this knowledge to a continent recently made available to white settlement. The writer has been actively engaged in determining the suitability of various areas of Australia for

⁷See Griffith Taylor, *Environment, Race and Migration*, Toronto, 1945, pp. 33, 34; and the table appended at the end of the book.

settlement, and has evolved several methods by which the complex factors of climatic control may be assessed in their relations to human settlement.

CLIMATIC CONTROL IN AUSTRALIA AND OTHER LANDS

During the last four decades the writer has been investigating climatic control in three very important regions of white settlement. Half of this period was spent in the sub-tropical and warm temperate lands of Australia, where a population, which is 98 per cent Anglo-Saxon, has settled a land in which hardly a section has an environment akin to any in Europe, to say nothing of the British Isles. For nearly a decade he lived in Chicago, and travelled through every portion of the United States. Finally, for the last decade he has been stationed at Toronto; and has crossed the Dominion a number of times in an effort to understand the controls which have determined the way in which the Canadian civilization is evolving.

There is a critical period in the development of a relatively empty land where it ceases to have the attributes of a pioneer region, and becomes "matured." This critical period is marked by a considerable change in the law of supply and demand. For instance, for a time the supply of lumber in the United States seemed well-nigh inexhaustible. During this period more and more capital was put into the lumber trade, and the product became in general cheaper and more abundant. Then rather suddenly, about 1900, the end of cheap timber loomed close; and at once the amount of timber for a given sum of money decreased rapidly. Many other examples of the "law of diminishing returns" could be given, but they all suggest that around 1900 the United States ended an economic period and became "mature."

Canada has not yet quite reached the end of the true pioneer stage; and in Australia it perhaps took place somewhat later than in the United States, but, I think, earlier than in Canada. It is suggestive that in the valuable book *Limits of Land Settlement*⁸ chapters were given to Australia and Canada—where unexploited territory was still to be found—but no special section was devoted to the United States. It is obvious that environmental control is more dominant in the pioneer stages of a country's growth; so that in Australia there is a well-known saying that the government leases "rainfall rather than land" in the

⁸Prepared under the direction of Isaiah Bowman, New York, 1937.

large empty spaces of that country. But, of course, after the pioneer phase is ended, and when in general a great increase in industrial activities occurs, there is still a great deal of control exercised by the environment.

Let us now turn to the conditions in Australia. We can twist around the meaning of the phrase "the proof of the pudding is in the eating" to illustrate what happens in a new country. The proof of "environmental control" in Australia is the fact that after a century and a half of settlement the population pattern is almost wholly determined by the climate. Indeed in 1916 the writer forecast the changes in the population isopleths during the next thirty years, and they have developed according to his forecast. However, the new settlers, whether in the United States, Australia, or Canada, usually proceed to many different areas in a somewhat hit-or-miss, not to say haphazard, fashion. If a region has been praised altogether too fulsomely—as is the habit of boosters in all countries—then before very long the new settlers migrate from this area to others where a living is easier to obtain. In the long run the environment dominates the nation's evolution.

No region has been cursed by the eulogies of the boosters to a greater degree than the tropical portion of Australia included in the Northern Territory. If it has a heavy rainfall, rich soils, cool nights, absence of tropical diseases, large forests, splendid harbours and abundant minerals—as many writers in the past declared—it seems difficult to explain the fact that the population (excluding aborigines) was 7,533 in 1888 and only 5,305 in 1936! Of course the misfortune of the non-scientific writer and prophet is that he has no map-sense, and is ignorant of the meaning of environmental control.

I became an officer of the Australia Weather Service in 1910; and it was my main endeavour, until I left Australia in 1928, to evaluate the factors which controlled Australian settlement. As regards the tropics I may say that my research could be characterized as a long-drawn-out period of disillusionment. It is true that the total rainfall of the tropics is fairly heavy (i.e., more than forty inches over rather large areas). But all this rain falls during three months in the summer, and the chief climatic feature of these northern coastlands is the long nine months of drought. The scientists soon realized from the natural vegetation, that this littoral is really "dry," since the plants are xerophytic, i.e., for the most part much like those in the arid part of

Australia. Nowhere in the northern coastlands are there any large areas of tropical jungle, resembling the luxuriant cover which occurs further north. In the East Indies such jungle is gradually replaced by sugar, rice, and tobacco plantations; but these islands occur in the areas having a *uniform wet* tropical climate.

Cool nights do occur in the interior, and are due to the absence of clouds (and of rainfall). After the sun has set, the land soon cools off in the absence of any cloud blanket to hold in the earth heat. But if you want cool nights you cannot have real tropical agriculture. Still, as I shall suggest later, some cotton, millets, and ground-nuts may in the future be grown in these summer-rain areas; though no white settlers anywhere else have done much in this respect in latitude 15°. The absence of tropical diseases is a genuine advantage; but it is coupled with the complete absence of any source of cheap labour. The few thousand aborigines in tropical Australia have so far declined to work on plantations, though some of them make good station-hands ("cow-boys").

There are no large forests, for no forest can withstand a nine months' drought, though there are quite narrow corridor-forests along the rivers, where the roots can benefit from the unusual water supply. In the same category of boosters' propaganda are the few score of palms, which grow around a permanent water-hole in the vicinity of Hermannsburg in Central Australia. Every Australian has seen photographs of these, but he does not realize that there are no other specimens within hundreds of miles of Palm Creek.

There are some fairly good harbours along this coast, such as at Darwin, Wyndham, and near Boorooloola. In the early days of settlement a good harbour was essential; but nowadays man can convert almost any roadstead into a fair harbour, so that it is not such an asset as it was formerly.

Mineral wealth has always been the greatest argument of the booster for new settlement. If some indications of mineral are found—and they are rarely absent in any large area of old rock formations—it is impossible to state that no bonanza will ever be discovered. For many years at the beginning of the century we heard a good deal as to "the fabulous riches of the Territory"; and now we can declare that "fabulous" was the right word! Apart from a little gold, tin, and wolfram there is no notable mineral production. The gold amounted to 5,000 ounces in 1935, about half of 1 per cent of the total Australian production; tin

was obtained in the same proportion; while the wolfram was only one-third of that mined in tiny Tasmania. With this brief discussion of the "wrong way to forecast settlement," let us see how the climatic maps help to give us a fairly accurate idea of the possibilities of Australia as a field in which a still more flourishing southern civilization may ultimately develop.

A COMPARISON OF POPULATION AND CLIMATIC MAPS IN AUSTRALIA

In my studies I made use of two techniques, which are easily understood. I used the actual population map of Australia as my criterion. The lines of density as plotted on this map gave a very definite pattern. These lines are *isopleths* of population, and form crescents enclosing the south-east portion of the continent as shown in the main map in Fig. 12a. What other *isopleths*—say of climate—give us the same pattern? If we find such a set (as we shall in the case of seasonal rainfall), then we may be sure that this element is the major climatic control. If, on the other hand, certain *isopleths* (such as those of temperature) run more or less at right angles to our population *isopleths*, then we may be sure that the temperature conditions are of much less importance. The second technique which I used was to find regions with the same climatic controls in older-established countries. These I called *homoclimes* of the Australian regions; and it seems logical to assume that as Australian settlement grows older, it will develop along the same lines as in the longer-established *homoclimes* elsewhere.

All the necessary data to determine the controls governing the distribution of the Australian people are given in the seven maps included in Fig. 12a. In the centre is the map of human density, and its *isopleths* will be seen to form a crescentic pattern with the most folk concentrated in the south-east, but with "wings" along the east coast and (with a break) along the south-west coast. More than half of the continent (the area ABCD in the main map) is practically empty, containing only about fifteen or twenty thousand settlers. This is a very small proportion, and is much less than 1 per cent of the total population of some seven millions. How does this illustrate environmental control? The writer knows of no better illustration which proves that in most parts of the world nature determines the logical and most profitable path for man to follow.

It is the province of the geographer to investigate such "patterns," and to show where the plans for national progress agree with the

indications of nature and where they depart from such indications. In the latter case they should be abandoned. For a number of years—from 1921 to 1928—the leading papers in Sydney contained controversies on this topic. Anyone who is interested in “nation-planning” from the geographical point of view will find many of these articles in the *Sydney Morning Herald* very illuminating. On July 30, 1924, this controversy of the “Boosters versus Professor Taylor” culminated,

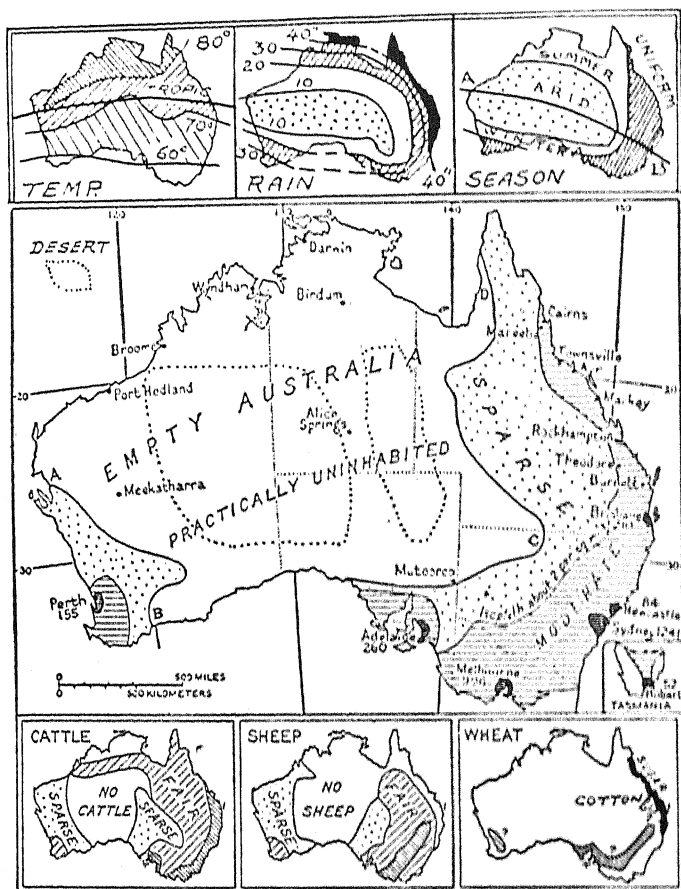


FIGURE 12a.—Map of Australia showing that the distribution of the population depends mainly on the season of the rain. Urban population is given in thousands. Areas ABCD contains only about 15,000 settlers. Small maps show annual temperature, annual rainfall, season of rain, and the chief economic resources.

when Hansard printed an impassioned speech by the Member for the Northern Territory in which he said that the writer "should desist from his perpetual slander on central Australia." The whole matter is discussed at some length in the writer's recent book on Australia.⁹

Let us now see what climatic charts agree most closely with the population isopleths, especially with the line showing "two persons per square mile" in the main map (Fig. 12a). In the top left chart (Fig. 12a) is shown the annual temperature. The temperature isopleths (known as *isotherms*) do not show any close relation to our population isopleths. Nor do the rain isopleths in the next little map.

When, however, we turn to the top right-hand map (Fig. 12a) showing "season of rainfall" the correspondence between the ruled area marked "uniform" and the region of "moderate population" in Australia is extremely close. In this uniform-rain area in Australia there is a good rainfall throughout the year, with at least eight months out of the twelve receiving one inch or more of rain. In the north of Australia there is a maximum rainfall in summer, while in the south the maximum rains fall in winter; the boundary is the line AB, which runs through Sydney. Inland of Sydney many places receive about the same rainfall (two inches) in each month of the year.

We may glance for a moment at the three small maps at the foot of Fig. 12a. These show the agricultural products upon which, until lately, the prosperity of Australia was based. (Today *industrial* products, produced mostly near the coal of Sydney and Melbourne, are becoming of great importance.) Wheat is by far the chief crop, constituting about 75 per cent of all crops, and it is found almost wholly in the winter-rain region of the south. Wool is the "cash crop" of Australia, and this also is found mostly in the drier winter-rain lands and in the drier uniform-rain lands of the continent. Cattle are densest along the south-east "dairy" coast in the uniform-rain region, where the regular rains give abundant pasture. Owing to the absence of frost, there are no barns in Australia; and this is perhaps the chief difference between a farming landscape in Australia and one in the United States. In the tropical hinterland behind the northern coasts is a valuable belt of "beef cattle"; but this industry employs very few settlers, and will never affect the distribution pattern of the human population very greatly.

⁹*Australia, a Study of Warm Environments and their Effect on British Settlement*, New York, 1940, pp. 99-100.

The areas devoted to sugar and cotton are shown in the last map (Fig. 12a). They are of little importance, except as illustrations of the utilization of sub-tropical lands by a completely Anglo-Saxon settlement.

To sum up, we see that the arid portion of Australia (top right map) is devoid of any notable settlement. It is customary on the part of "wishful thinkers" to state that this is due to the "newness" of Australian settlement. This, however, is not a reasonable argument, for there was a military settlement on the north coast as early as 1824, and such settlements were maintained there till 1848. Indeed, the first large extent of the Australian coast to be placed on the world maps was the arid western and north-west coast. This was known to the Dutch for 160 years before the first real settlement at Sydney in 1788.

The borders of settlement in Australia are determined by the possibilities for the grazing of stock. All the land which could be used for this purpose was known, and almost all of it was sparsely occupied, by 1880. The pioneer belt in Australia has always been known as the "Never-Never" country, and we may be sure that the hardy squatters in the Never-Never would long ago have "taken up" the more arid lands, if they had been worth even sparse pastoral occupation. There is unfortunately a large area of real desert in Australia. Some eminent climatologists (such as Koeppen) would label almost all the arid area shown in the small map (Fig. 12a) as "desert." The writer has, however, demarcated the two "practically hopeless" portions of the arid region, and has confined the term "desert" to these two areas. They total about 700,000 square miles, and are shown by dotted lines in the main map (Fig. 12a).

Of course, population density is not synonymous with civilization. But no one will deny that a happy and prosperous population, with sufficient leisure from the task of obtaining a mere subsistence, is the best *milieu* in which civilization can evolve satisfactorily. In the south-east of Australia (and in the adjacent Dominion of New Zealand, to which I can devote no space) the conditions for the growth of such a civilization are better than in most parts of the world. In this corner of the continent the climate is excellent, better in the writer's opinion than the far-famed Riviera or California. It is, however, the characteristic of the Australian continent that the environment deteriorates unusually rapidly toward the centre; so that, in the writer's opinion, the distinction between "economic Australia" (in the south and east) and "empty Australia" (in the centre, north, and west), will always be very marked;

and will be a determining feature in the future development of Australian civilization (Fig. 9).

HOMOCLIMES AND HYTHERGRAPHS

A few words may now be said about the second technique which the writer found of great value in comparing the possibilities of various places in Australia with those of older-settled parts of the world. No booster in Australia denied that white settlement of a permanent nature would be difficult in Calcutta, or at the mouth of the Congo in Africa. My purpose in working out homoclimes for Australian centres was to show such facts as that Townsville had essentially the same climate as Calcutta, while Broome (on the north-west coast) was a homoclime of Banana at the mouth of the Congo. Why any climate in Australia should be quite satisfactory, while the same in a foreign land should be extremely unpleasant, my opponents were never able to explain!

The best picture of the climate of a place, in the writer's opinion, is obtained by a composite graph, which charts both the temperature and the rainfall at all times of the year. To this graph I gave (in 1917) the name "Hythergraph"; which is a composite of *hyetos*, rain, and *thermos*, heat. Such graphs for all types of climate in the world are charted in Fig. 13. Let us see how the hythergraph for Sydney is drawn. In Sydney the temperature in January is about 72° F., while the rainfall for the month is three and a half inches. Plotting these two figures in accord with the scales at the side of the graph, we obtain the position labelled *Ja* in the Sydney graph. Carrying out the same procedure for the other eleven months, gives us a twelve-sided figure, i.e., the Sydney hythergraph.

Another Australian example is the graph for the little village of Urandanji. This is situated in the far west of Queensland in the hot, arid interior, close to the true desert. Its graph appears in the top left corner of Fig. 13. In this case the January temperature is 86° F., and the rainfall about one inch. The whole graph for Urandanji is of a very different shape, and situated in an entirely different part of the whole base-map. Three well-known types of environment are indicated by the words "Desert," "Muggy," and "Raw"; and these are marked in the appropriate parts of the base-map. In the centre of the graphs is a black rectangle, which includes those ranges of climate which most Europeans would accept as comfortable. Nearly all Sydney is seen to

CHAPTER III

RACIAL CHARACTERISTICS AND DIFFERENTIATION

EARLIEST TYPES OF MAN

IN the two previous chapters we have investigated the plan of the world as regards structure and climate. We are now prepared to discuss the early evolution of man as affected by the environment, and the major classifications of man which concern the human races. No one who has studied the problem doubts that man evolved from some ape-like ancestor several million years ago. Linnaeus, as far back as 1764, suggested the close relationship between the apes and man, though it remained for Darwin and Huxley around 1860, i.e., a century later, to prove the connection.

A second problem, which aroused great interest in the early nineteenth century, concerned the age of man on the earth. The orthodox view was that of the learned Bishop Usher, who dated the Flood and other events in early biblical history about 4000 B.C. Around 1800 doubt was cast on these dates by the discoveries of skeletons of primitive man in the west of England. A Catholic priest, McEnery, suggested in 1825 (as the result of his researches in the caves of Torquay) that man was contemporaneous with the long extinct Mammoth.

Boucher de Perthes made extensive collections of flint implements in the Somme valley. These he declared were of human origin, long before Prestwich and other British geologists corroborated his opinions in 1853. It has, however, remained for modern investigators to link these two lines of research, to show where man originated, how man originated, when he originated, and—a problem which is still very controversial—whether or not there may have been several ape stocks, each giving rise to a race of men. Indeed, there is still great debate today as to whether modern man is descended from Neandertal man, or from some other early form which branched off from the human “tree” considerably later than did Neandertal man.

The antiquity of man is a subject which need not concern us long, since we are mainly concerned with the ecological aspect of the problem. It should be clear from the preceding chapters that evolution is largely the result of constantly applied stimuli. As stated earlier, these lead, in

the course of millenia, to those marked changes in the bodily characters which we call racial characteristics. But it seems almost certain that cultural changes, such as have led to the growth of civilization, are due to somewhat similar stimuli, though they acted very much more speedily. Hence the cradleland of early man had much in common with the cradleland of primitive civilization. Indeed it seems likely that in a few decades we may be able to prove that both these leading events in human history occurred in south central Asia, somewhere in the vicinity of the Caspian Sea and Persia (Fig. 28).

Boule in his book *Fossil Man*¹ puts the case for south Asia rather clearly in the following words: "The Siwalik Hills [100 miles north of Delhi in India] show that in that region about the upper Miocene and lower Pliocene periods [i.e., about ten million years ago] there was a most extraordinary "Flux of Life," especially among the higher Primates. Asia was the laboratory where the differentiation of the ancestors of mankind must have been in process of elaboration."

The term "Flux of Life" means, of course, evolution, and the astounding variety of ape-like genera found fossil in the Siwalik Hills may be gathered from the following list, which is taken from Mitra's book on the prehistoric peoples of India (Calcutta, 1927).^{1a} The first three genera have some human affinities, and are as follows: *Dryopithecus*, *Sivapithecus*, and *Paleopithecus*. The remaining types (including fossil ghouls and orang outangs) are akin to the apes and monkeys. They are *Simia*, *Sennopithecus*, *Papio*, *Anthropithecus*, *Cercopithecus*, and *Macacus*.

No apes or ape fossils have been found in the New World, and no series of ape fossils akin to those here mentioned have turned up in any other portion of Asia to date (Fig. 15a). Of course detailed study of the late Tertiary beds in Asia is only just beginning, but one would expect that ape man and early man alike would be evolved in the warmer southern parts of the great land mass of Asia rather than in any of the northern portions of the continent. For reasons developed earlier, we may assume that regions of some considerable seasonal change would be most likely to promote evolution, while an environment on the border of warm woodlands would *a priori* seem to suit both apes and ape-men as their natural habitat. All these features are to be found in

¹Marcelin Boule, *Fossil Man Elements of Human Palaeontology*; translated from the French by J. Ritchie, Edinburgh, 1923.

^{1a}P. Mitra, *Prehistoric India*, Calcutta, 1927.

the Caspian-Persia area already suggested, while they would not be so well developed in any northern or coastal portion of that continent. We must not, however, forget that the topography of this region in late Miocene times was very different from what it is now. However, even in those early times we may be sure that the interior of a continent, even if lower and wetter and hotter than now, would certainly be more stimulating than the coastal areas.

A recent study of human evolution in India by Hellmut de Terra² contains the following paragraph, which is well worth quoting. He believes that these Siwalik mammals migrated to the south during Pliocene times owing primarily to climatic changes; and goes on to say:

The major migration-route evidently led along the coast ranges of Burma towards the delta lowlands of Malaya and south China; and the final stage of dispersal towards Java was reached at the very close of Pliocene time, when this island had just fully emerged from the sea. On such a route the climatically specialized animals would have encountered genial habitats; and at the same time the varying nature of the countries they crossed would have stimulated their evolution. . . . The ultimate emergence of certain protohuman types may be expected in various regions of tropical southern Asia.

Before considering ape-man, or whether modern man is descended from Neandertal man, it will be well to anticipate one of the main conclusions of the Zones and Strata theory (see page 54), to the effect that primitive types in a series survive longest in the marginal areas of dispersion, and not in or near the cradleland. Hence it would seem obvious that the sequence of events in a given evolutionary series cannot very satisfactorily be investigated in the marginal areas where only the last types will be found. Yet this is precisely what most anthropologists have been doing for the last hundred years.

Western Europe or eastern Asia are clearly two of the least satisfactory places for arriving at a clear picture of the ancestry of man. Now that research is being carried on in Palestine and Mesopotamia, we are much more likely to arrive at a clear understanding of early evolution and of early civilization; though it would be still better to investigate Persia and Turkestan, for reasons suggested later.

We can make a rather interesting deduction from the sites where the most famous ancient skulls have been found (Fig. 14). Trinil was the first of such sites, in the east centre of Java, where the earliest

²Hellmut de Terra, "The Siwaliks of India and Early Man." See *Early Man*, edited by G. G. MacCurdy, Philadelphia, 1937.

Pithecanthropus type was discovered.³ In Queensland near Brisbane another extremely ancient skull was discovered near Talgai (Fig. 15a). In Rhodesia is Broken Hill, where another of these proto-Neandertal types has turned up. The famous Piltdown skull was found in a roadside gutter amid some ancient gravels near Lewes in Sussex, England. Our study of the Zones and Strata theory will indicate that these places are all far removed from the original cradleland, which must be at some central spot from which all the groups containing the originals of these

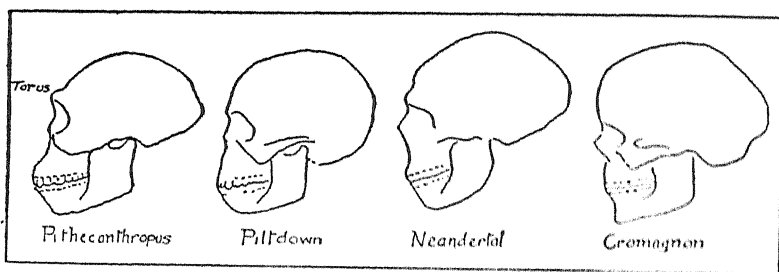


FIGURE 14.—Outlines of some primitive skulls (from restorations by W. K. Gregory) showing the gradual enlargement of the front of the brain and the reduction of the jaws.

widespread examples must have migrated. The most logical centre—from which we can prove that the later races migrated—is, of course, the south centre of Asia (Fig. 15a).

In South Africa several skulls have been investigated which are assigned to a creature called *Australopithecus*. According to Broom these belong to a common ancestor of the chimpanzee, gorilla, and man; and *Australopithecus* is the fossil ape nearest to man's ancestor, so far as we know at present. As Broom points out, the teeth of this African genus are nearer those of modern man than are those of the undoubted human type from China called *Sinanthropus*. "This would seem to indicate that in Pliocene times there was a considerable number of types which had evolved in different ways, and that it was from only

³W. F. Oppenorth is of the opinion that various skulls recently found in Java at Ngandong are close to the Rhodesian skull from Broken Hill. While agreeing with other writers that these folk were not Neandertal men, he thinks with Keith that they are near the base of the stem which afterwards branched out into *Homo sapiens*. It is reasonably sure that this conclusion will be modified in the future, so that the Rhodesian type and *Homo sapiens* will be found to be linked by many varying types to Neandertal man (see *Early Man*, 1937).

one of these types still unknown, that modern man arose." We shall return to this point somewhat later, since it does seem possible that the Negrito race (or pygmy) was descended from a somewhat different stock than that evolving into the other races of man.

This important concept of gaps in the line of human evolution may be illustrated by a consideration of the history of Greenland. Investigators in that country find a good deal of evidence of a Viking civilization which existed during the years A.D. 1000 to A.D. 1400. Then there is a great break until 1721, when Hans Egede founded a settlement at Godthaab. If we knew nothing of the history of Scandinavia (except what is found in Greenland), we might assume that there was little connection between the primitive civilization of the Vikings in Greenland and the advanced civilization of Egede some 300 years later. Of course in Scandinavia—the original cradleland of the culture in question—there has been a continuous evolution, though a great break in the process would seem to be apparent in Greenland.

For these reasons it should be clear that western Europe is not a good place to learn the complete history of early man. Geographically western Europe is essentially a marginal area, and was often the refuge of primitive and broken tribes. Nothing is more probable than that many migrations of primitive peoples did not reach as far to the west of the cradleland as France or England. Hence the anthropological sequence is certain to be much interrupted. Thus the considerable break between the Neandertal type of man and the so-called *Homo sapiens*, such as Cromagnon man, represents one of these chronological gaps, rather than any real break in the human ancestral tree. We do not need to invoke "sports" to explain the new migrants.

Many years ago it seemed clear to me that investigations in the Near East would reveal "missing links" between the Neandertal types and later races. One of the early skulls from Galilee has since been described by Sir Arthur Keith as having a number of characters which link the Australian aboriginal, Neandertal man, and *Homo sapiens* of the European type. For instance, the endocranial convolutions are comparable with those of the Australian. Moreover, the torus, frontal width, and the bregma height are more advanced than those of the Neandertal type.

However, the more these early times are investigated the more we are driven to the conclusion that there was considerable diversity far back in ice-age times. The Swanscombe skull found in southern

England, and the Steinheim skull found in the Neckar valley in Bavaria in the last few years, both belong to these somewhat "advanced" types of Neandertal man. Hence as far back as Acheulian times (i.e., 300,000 years ago) there may have been a few representatives of the evolving *Homo sapiens* among the more numerous and dominant Neandertal men even in western Europe.

THE CONCEPT OF RACE

There are many different attitudes with regard to the question of race, and since this subject is almost wholly ignored in the usual courses of education, some discussion would seem to be in order. In the period before the two world wars it seemed obvious that the conflict between the so-called "coloured" and "white" races was the most important of all the problems with an ecological slant. The current opinions of the layman were so much at variance with the teachings of anthropology—especially of the new ecological anthropology, based on studies of environmental change and on human zones and strata—that the writer introduced such topics into his junior university courses upon human distribution nearly a quarter of a century ago.

There has been a shift in the major interests in race during the last decade, largely owing to the fallacious ideas so vigorously put forth by the proponents of the Nordic and Aryan "fetishes." It is, of course, no less necessary nowadays to understand the fundamentals of race; for it is obvious that we cannot controvert the teachings of the Nazis if we have no better racial knowledge than that possessed by Hitler.

As suggested already, there is no real agreement among anthropologists themselves on the vital question of the racial composition of the peoples of the world. The vast majority of them are much more interested in cultural anthropology, linking with sociology and psychology, than in racial ecology. Only one or two researchers in America and England are specially concerned with the fundamentals of race as regards world-wide classification and distribution. For these reasons it seems likely that the conclusions of such early investigators as Blumenbach and Cuvier have been accepted much too readily.

On this continent Dixon (of Harvard) brought out in 1923 a study of race which agreed in essentials with the scheme worked out by the author in 1919.⁴ Dixon also threw overboard the old style of classifica-

⁴"Climatic Cycles and Evolution" (*Geographical Review*, Dec., 1919, p. 316).

tion, which still links a race with a given continent and colour. Thus Africa is said to be the home of the *black* Negro race; Asia the home of the *yellow* Mongolian race; Europe of the *white* Caucasian race; America of the *red* Amerind race; while Malaya is credited with still another type of race.

These categories are based on wrong premises, and must sooner or later be abandoned. We shall see that the true picture is very different; and in essence postulates five major races, which have proceeded out of Asia into the three world peninsulas (as described in chapter 1) in accord with ease of access. As a result, we have living representatives of all these five races in Asia and Malaya; of three of them in Africa and America; and of two of them in Europe and Australia. The fossil evidence corroborates the race history.

In addition to those scientists who are willing to agree that there are, say, half a dozen major races, though they differ as to the definitions of these races, there are two other groups of anthropological students. One of these declares that there are so many variations, and that these grade so indefinitely into one other, that there are *innumerable* races. They say that we must wait many years before we have collated the data requisite to determine the major classes.

The other group goes further and states baldly that there is *no such thing as race*; and that all human beings are variants depending on minor modifications, usually due to isolation in differing environments. The answer to the objections of these two latter groups is that botanists and zoologists do not suggest that *their* classes should be abandoned. The latter scientists know quite well that every plant and animal is descended from a simple cell, and in that sense can be linked to every other plant or animal; though it is highly unlikely that all the innumerable "missing links" will ever be clearly made out. No doubt the absurd stress laid upon race by the Nazis has tended to make certain anthropologists swing to the other extreme. Indeed, though the author is strongly in favour of racial classification, he agrees that in most cases the effect of race is negligible compared with that of environment and culture.

THE ZONES AND STRATA TECHNIQUE EXPLAINING DISTRIBUTIONS

It was his use on world maps of the isopleth method in charting the criteria of race, in conjunction with the findings in W. D. Matthew's

mémoir "Climate and Evolution,"⁵ which led the writer to publish the "Zones and Strata" classification of races in 1919. The general principles of this concept are illustrated in Fig. 15. Here three parallel cases of evolution are considered. All anthropologists will agree with the explanation of the block diagram on the left, which deals with the *methods of transport* in use in the vicinity of Sydney, Australia.

In 1924 I was in the interior of New South Wales about 200 miles to the north-west of Sydney, when I came across an ox-team moving the goods and chattels of a farmer from one district to another (Fig. 15, left). In 1824 such a sight would have been common in the centre of settlement in the new continent, i.e., in the streets of Sydney.

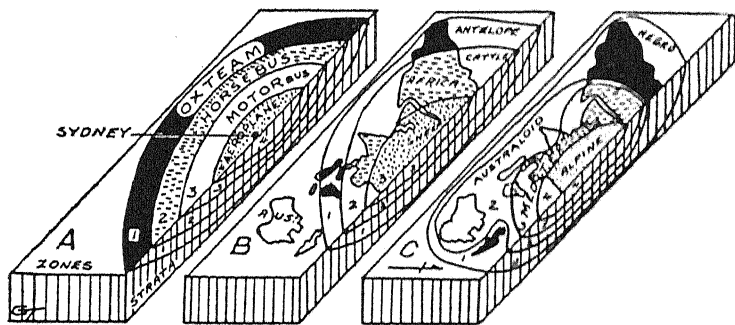


FIGURE 15.—The Zones and Strata concept applied to the evolution of transport (A); of even-toed mammals (B); and human races (C). In each case the cradleland is at the centre of the zones, and the earliest, most primitive, type (1) is pushed to the margin.

Moving nearer to Sydney on my journey I got a photo of one of the old horse-buses, still labelled with the name of a department store in Sydney, in which city it had plied about the year 1890. It had been "pushed out" from the metropolis by the use of much more rapid methods of transport. Nearer Sydney again, I found the automobile in general use everywhere, while in the metropolis aeroplanes were a common sight as they flew around the airport near the harbour. These four photographs I have used for twenty years to illustrate the invaluable "Zones and Strata" concept.

In an old dump-heap in an engineer's yard in the city, one might (if lucky) find "fossils" of all these four methods of transport; the order

⁵"Climate and Evolution" (*Annals, New York Academy of Sciences*, vol. xxiv, Feb. 18, 1915, pp. 171-318).

of superposition of the strata being that of the four zones already discussed. At the bottom of the heap might be some mouldering remains of an old ox-yoke. Above this would be perhaps the harness of one of the horses from the old bus. The upper stratum of the heap would undoubtedly contain many broken parts of automobiles, while at the very top we may guess that some pieces from aeroplanes might be thrown aside.

In the block diagram at the left of Fig. 15 the relation of the zones on the surface to the strata (shown on the right-hand face of the block) is quite clear. The older method of transport has been pushed to the margin of the zones, and is also found at the bottom of the heap of strata. Any student of cultures would agree that these data are sufficient to show (a) the cradleland of the methods of transport (which is Sydney in every case); and (b) the order of evolution of the methods under discussion. The most primitive type is always found pushed to the margin, and is never found active at the cradleland; secondly, if we follow the zones from the margins to the centre, we learn the order of evolution of the types concerned.

It was Matthew's great accomplishment that he used this concept to explain the cradle of development and the order of evolution of the higher mammals. His large memoir on this topic, "Climate and Evolution,"⁶ is perhaps the most stimulating research that the present writer has ever read. Matthew showed various diagrams, which I have collected into the middle block diagram of Fig. 15, in regard to the evolution of the even-toed animals, such as the antelopes, cattle, and sheep.

Their original distribution in the Old World is shown as the surface zones. The antelope is the earliest type, and it occurs in South Africa and in the East Indies. Cattle are the intermediate type, and occur in the intermediate habitat, as shown by the dashes while the sheep is the last evolved, and is found in the heart of Asia as suggested by the dots in the central diagram (Fig. 15). If we dig in central Asia we find that the fossils corroborate these zones. The upper beds show that cattle once lived in this region, though mostly extinct before man modified their natural habitats. In older strata below those containing cattle fossils, we find the relics of the still earlier antelopes.

Matthew did not dwell much on the climatic changes which produced these migrations from Asia into the outlying "peninsulas" of

⁶"Climate and Evolution," *loc. cit.*

Europe, Africa, and the East Indies. But Fig. 15a shows how the lemurs and apes were affected during the thirty million years of Tertiary time. In early Eocene times the centre of Asia was lower, hotter, and wetter than it is now. We know from the fossils that the primitive monkey called the lemur lived then in the region near the Caspian. As time elapsed, the Asiatic continent became cooler, drier, and more elevated. The lemurs slowly marched to the south, keeping pace with the movement of the forest belts which best suited them. Today they are found only in hot, wet Africa; and in the similar environments in the East Indies.

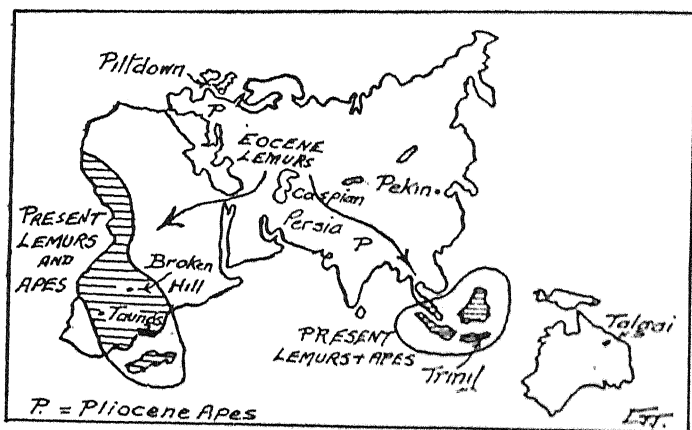


FIGURE 15a.—A map, based on Matthew's data, showing how the cooling climates forced the lemurs and apes out of the heart of the Old World into the southern equatorial lands.

In late Tertiary times the later "missing links" were forced out of Asia for similar reasons, and they survived much longer in the marginal lands. Hence their latest fossil relics are found in these marginal lands (not in the heart of Asia); as is indicated by the classic sites of apemen at Trinil, Talgai, Broken Hill, and Taung.

To return to the analogies presented in Fig. 15, if the recognized criteria of the races of man are charted (i.e., hair texture, skull width, etc.), it is found that the lines of distribution (isopleths) come out as shown in the right-hand diagram. From a consideration of such isopleth maps, one is driven to the conclusion that current classifications of race are erroneous in important respects.

In the right-hand diagram in Fig 15 four of the main races are indicated. They are found to lie in zones about south central Asia; and in later sections it will be shown that these zones of race agree in essential details with those of the higher mammals. Surely we should expect this; for the differentiation of races occurred during thousands of years, and was completed long before man became civilized. Why, therefore, should early man's zoning differ in any notable fashion from that of his immediate predecessors, the higher mammals?

It seems fair to state that the technique based on the "Zones and Strata" is one of the geographer's chief contributions to the study of distributions. In a word, by its use we may "deduce evolution from the map." The following description of the concept is given in general terms, and shows how it can be used for races, languages and other culture facts, animals, and plants.

If there be a centre where evolution (whether of organic or inorganic type) is taking place . . . then, after a reasonable lapse of time, the various differentiated classes will be found to be arranged in zones . . . so that the most primitive is at the margins, and the most advanced at the centre of the series of zones. Thus the earliest class will have covered the greatest area in its migrations; but fossil evidence of this class will be found buried in the deepest stratum, under the later strata at the centre of evolution. This is the "Zones and Strata" concept, which is less clearly called the "Age and Area" concept by certain biologists.

It has always seemed inexplicable that orthodox anthropologists are willing to accept the classes of race which were originally propounded by Blumenbach in 1806.⁷ What other science has been so conservative that it has been willing to accept the findings of an almost unscientific period, and use them for a century and a half? Blumenbach devised the "Continent and Colour" classification. He said in effect: There are four main continents and four main racial colours, so that here is the simplest classification: all folk who live in Europe are the white race (whom we call Caucasians); almost all the folk who live in Asia are the yellow race, whom we will call Mongolians; those living in America are the red race (later called Amerinds); while almost all the folk in Africa are the black race, known as Negroes. In the islands to the south-east of Asia he found a brown race, known in the early days as the Malay race.

This honoured scheme was devised without any knowledge of modern biology, climatology, topography, or changing environment.

⁷The best history of anthropology is that by E. von Eickstedt, published in the *Zeitschrift für Rassenkunde*, Band V, Heft 3, 1937; Band VI, Heft 1, 1937.

All these are vital in elucidating our problem of the differentiation of man. However, few modern anthropologists have concerned themselves greatly with these factors, which is no doubt the main reason why they fight shy of a classification based thereon in large part.

The ecological approach to the classification has found favour with biologists, paleontologists, climatologists, and geographers, but there hardly seems to be one anthropologist who has discarded the Caucasian-Mongolian and other Blumenbachian absurdities in favour of a biological classification such as is propounded in the present volume. Indeed, apart from a few like Dixon and von Eickstedt, few of them are much interested in racial differentiation, but pass on rapidly to that valuable but distinct branch known as Cultural Anthropology. On the other hand, most of the anatomists studying human variations rather ignore racial classes altogether, perhaps claiming that we should collect more data before venturing to classify human varieties.

RACIAL CRITERIA

It will be sufficient to traverse quite rapidly the criteria which are usually considered in determining the character of a major race. The layman's reliance on skin colour has no warrant. This is the one characteristic which is most readily changed by a slight modification of the environment; as witness the tan obtained by a few days' exposure to the sun. The colour of the Negro is due to a deeper deposition of the same pigment cells within the skin, though it is permanent in this case. However, as later maps will show, the colour of the skin is very variable amid most of the so-called higher races. Body height is another criterion which also alters readily. The local name for the second white generation in Australia was "Cornstalk"; given in recognition of the fact that the healthy environment around Sydney resulted in a great change in stature among the new colonists. However, an abnormally short stature seems to be a definite character of the Negrito race, as we shall see later.

Among the criteria generally accepted as quite significant are two: the character of the hair, and the width of the skull. In the former case we find five classes, which are sketched in the third line in Fig. 16. The "curliness" of the hair ranges from the "peppercorn" type (i.e., tight

^aRoland Dixon, *Racial History*, New York, 1923. E. von Eickstedt, *Rassenkunde und Rassengeschichte der Menschheit*, Stuttgart, 1934.

separate curls, with much skin showing between); through the frizzy type; to curly, wavy, and straight. These are characteristic of the five major classes which the writer believes to be the most satisfactory racial groupings, whether we consider biological or ecological data. They are Negrito, Negro, Australoid (i.e., like the Australian aborigines), Mediterranean, and Alpine (see Fig. 16).

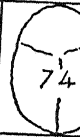
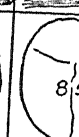
		Negrito	Negro	Austr:	Medit:	Alpine-Mongol
HAIR	Hair Section	(40)	(50)	(60)	(70)	(80)
	Color	Black	Black	Black	Brown to Black	Brown to Black
	Wave					
Skull						
Jaw						
Eye		 Bushman	 Negro		 English	 Tatar
Nose		 ↑ 100 ↓ 100	 ↑ 100 ↓ 100	 Kol	 Paris 69	 Galcha 66
Height		 Atka 1400 m.m.	 Wolof 1725	 1667	 E. English 1700	 Kirg 1640
Skin Color		Usually Black	Black to Chocolate	Dark brown to Olive	Light brown to white	Light brown White + yellow

FIGURE 16.—Scheme illustrating variation in ethnological criteria in the five major races. Hair-wave and skull-width are the chief criteria. (From *Environment and Race*.)

The width of the skull is usually combined with the length of the skull to produce the well-known cephalic index. For instance, most of the folk in Britain have a cephalic (or head) index around 79. In this case the greatest length of the skull (front to back) might be

190 mm., and the greatest width (between the ears) 150 mm. If the width is expressed as a percentage of the length, then we get the head index, i.e., 79. In the case of folk from central Europe the index is usually around 84; which would indicate a skull with a length of nearly 187 mm., and a breadth of 160 mm. Among all the people of the world, few have head indices below 70; and few above 90. The averages for the five races are added in the fourth line given in Fig. 16. Apart from the aberrant Negrito, there is seen to be a fairly regular sequence in the series from Negro to Alpine.

A great deal of attention has been given to certain data obtained by Boas some thirty years ago, which seem to show that head index changes very rapidly under such slight changes of environment as are involved in emigrating from Italy or Poland to New York. It is important to note that these changes are extremely small, barely modifying the index by one unit; and it should be remembered that Morant and Samson (who have subjected his statistics to careful analysis)⁹ have recorded that "considerably larger divergences would have to be found to establish the fact that head-form is directly modified by environment. Boas' theory cannot be upheld." To the impartial reader it must seem inconsistent that those anthropologists who accept Boas's theory of rapid change have no hesitation in also accepting the unity of the Mediterranean race from Ireland to India. In the latter case the folk concerned have been subjected to varying environments for several millenia, yet their characteristics have not apparently varied in any noteworthy degree. (Be it noted that the author believes that races do evolve through changing environment, but the time involved is inconceivably longer than that postulated by Boas.)

In Fig. 16 several other criteria are charted, such as the shape of the jaw, which varies from prognathic in the Negro to orthognathic in the Alpine race. So also the character of the wings of the nose varies from race to race. The broad flattish nose of the Negro (platyrrhine) is very different from the narrow (leptorrhine) nose of the typical Mediterranean or Alpine. There seems to be no regular evolution in the stature such as is apparent in most of the other criteria. Negroes are over 5 feet 6 inches and are distinctly taller than Alpines; while the Negritos—as mentioned earlier—are usually under 4 feet 10 inches. The aborigines of America—usually incorrectly assumed to be of one

⁹*Biometrika*, June, 1936.

race—vary very greatly: from the tall Plains Indians and Patagonians, to the extremely short tribes of Central America.

It seems likely that continued exposure to a hot sun will indirectly in the long run lead to a permanent and inherited darkening of the skin. This would be an example of "the inheritance of acquired characteristics"—anathema to the orthodox biologist—unless one invokes a "sorting of the genes," which they are willing to accept. For instance, it seems probable that in Australia the blonde European suffers much more from skin ailments of various sorts than does the dark-skinned European. In the course of hundreds of generations it may be that the blonde types will be weeded out; thus changing the type of the "white" Australian in regard to colour. So also it seems likely that the skin of the Negro has several attributes which enable him to get rid of bodily heat much more readily than does the European. If we may believe Dr. C. A. Mills, this gives the Negro a tremendous advantage as regards permanent occupation of the tropics.

In 1919 the author had the temerity to produce a new classification of the races of man, which was due to his ecological approach to the problem. It may not be out of place to describe why I was led to differ greatly from the orthodox views. I received a request from the Commonwealth government to investigate the climates of Australia, with a view to discovering if there were features which made it likely that the so-called "Yellow" race could flourish better in Australia than the so-called "White" race. It was not hard to show that there were environments in Asia which were homoclimes (i.e., similar climates) of all those found in Australia. Furthermore the population density was far greater in all these regions than in the homoclimes in Australia. But I had been reading with the most lively interest Matthew's recent memoir "Climate and Evolution,"¹⁰ and it seemed to me to be a very interesting research to find if an accurate plotting of the physical data regarding hair, skull, nose, height, colour, etc., would show migrations of the same type as those which characterized the higher mammals.

It seemed to me logical to assume that the contradictory classifications of the early anthropologists could be tested by using the Zones and Strata theory, which has been explained earlier in regard to plants and animals. One may be quite sure that the tribes who wandered around the Old and New World before the dawn of civilization were controlled by much the same needs and desires as the higher mammals; and

¹⁰"Climate and Evolution," *loc. cit.*

and by a head index which sharply separates them from most of their neighbours. In the last map given in Fig. 19, island refuges of the Negritoes can be made out in the Philippines, and in the Andamans in the Bay of Bengal. Their refuges in the mountains of large islands (distant from the heart of Asia) are illustrated in New Guinea and Tasmania. They occur in the marginal desert of Kalahari (in South Africa); while in the one-time impassable tropical jungles of the Congo we find another group of these same pygmy people.

The next zone comprises the Negroes with a head index lower than 75, and with frizzy hair. The Australoids come in near the Negroes; but on the whole nearer the centre of dispersion, as will be explained later. They occur chiefly in India and Australia, and of course have wavy hair.

All round the Old World is a belt of intermediate people with head indices from 75 to 79, and with wavy hair. They are gradually being accepted as belonging to the Mediterranean (or "Brown") race; and any student of the meaning of isopleths would accept their position as due to migrations outward from the heart of the Old World. Lastly we find in the centre of the zones the broad-headed people with straight or nearly straight hair, who are grouped together under the name Alpine.

The Zones and Strata theory tells us that the cradleland of the races is in the centre of these zones, i.e., in the south centre of Asia. It further leads us to suppose that the order of the zones is also the order of evolution. The Negrito is the earliest type of those still surviving. Some type not unlike the Negro gave rise to the Australoid. This in turn after many millenia was modified into the Mediterranean. Finally, the Alpine type of central Europe and Asia developed in turn from some type akin to the Mediterranean, and represents the latest of the five races. The word "latest" is used in the sense that the sheep represents the central and latest type of Matthew's sequence antelope-cattle-sheep (Fig. 15); or that the horse is the central and latest type of another arresting sequence, tapir-rhinoceros-horse.

THE ACCESSIBILITY OF THE CONTINENTS

Before investigating in some detail the present-day distribution of the five major races it will be well to consider the relation of the other continents to Asia with a view to understanding the way in which the prehistoric migrations occurred. What was the condition of affairs

during the later ice ages, when these racial differentiations and migrations were taking place in Asia? It should be obvious that the arrival of various races in the far west of Europe, which is the region where the most accurate dating has been worked out, gives us very little clue as to the period of the various evolutionary steps in Asia. It seems not improbable that such a change as the gradual evolution of the Neanderthal man into something like a Cromagnon type took place in Asia possibly 150,000 years ago; although the Cromagnon type did not appear in France until some 50,000 years ago.

The relation of the continents is sketched in Fig. 18 with Asia in the centre. This somewhat unusual projection was favoured by Matthew in his classic studies of mammalian distributions and has always been

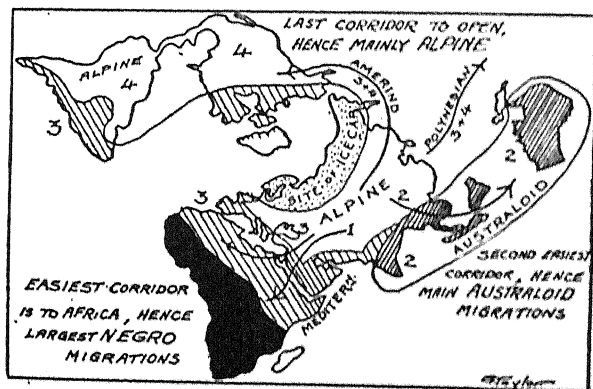


FIGURE 18.—The order of major migrations from Asia agrees with the accessibility of the outlying continents. Africa, Australia, and America were entered in this order. The racial zones support this hypothesis.

adopted by the present writer in his discussions of human migration. It emphasizes the peninsular character of America, Australasia, and Africa; and seems to demonstrate that, other things being equal, the primitive tribes which left Asia would reach the other continents according to their accessibility. During the later ice ages we may be sure that few tribes moved north from the Asiatic cradleland, and so the Bering Corridor into the Americas was closed to them. As regards the other continents it is clear that Africa is much more readily entered than Australasia. The former could be reached dry-shod, and it is probable that the falling in of the Red Sea "graben" (depression) took place quite lately in geological time. In these circumstances there was

little to prevent a wholesale migration of the earliest peoples into Africa; and we may be sure that such took place.

Africa on the whole is a region of uniform tropical climates. It is the continent where stimuli leading to rapid evolution are singularly absent. Speaking generally, we may say that a tribe which was pushed into Africa would stagnate under the unfavourable conditions which obtain there. Thus it may be accepted that the main developments of race occurred in the stimulating regions of central Asia, and that not much change occurred after the primitive tribes reached their present tropical habitats in Africa.

We must accept the laws of probability for our guide as to the proportions of Negritoes or Negroes who moved into the African and Australasian "peninsulas." It should be clear that a small proportion of both races might leave Asia by the south-east corridor, i.e., by the "stepping stones" into Australasia which we call the East Indies. For we must remember that in these far distant ages, probably 100,000 years ago, primitive man had no knowledge of what lay ahead of him as he was thrust from his homelands in Asia. He wandered on obeying the same laws as did the higher mammals, and indeed no doubt followed those of them which constituted his normal prey. But he differed from the lower creatures in one important respect. He could make a raft, and so could cross wide stretches of the sea. Such a marine corridor was blocked for the vast majority of mammals; though small creatures like rats, accidentally carried on floating timber, and flying mammals like bats, could cross such obstacles.

Hence, though most of the tribes moving to the south-east were blocked by the terrible ranges of Burma, or by the numerous straits in the East Indies, yet a small proportion of Negritoes reached New Guinea and the Philippines, and a much larger number of Negroes reached New Guinea, and Melanesia to the east of that large island. We can now understand why the Oceanic Negroes—as they are called—though they are kin to the African Negroes, are very much less numerous.

It is also worth remembering that during the ice ages the oceans were about 200 feet lower than they are now. The water was locked up in the great ice caps of Europe, Asia, and North America, as well as in the much thicker layers of ice in Greenland and Antarctica (Fig. 18a). In the seas surrounding the East Indies we have some of the shallowest waters on the face of the globe. Plenty of evidence tells us that these

waters have only recently invaded wide areas of land. We can still trace the rivers now drowned beneath the sea. We find that the fresh-water fish are of the same species in Borneo and Sumatra; though biologists tell us that species begin to vary fairly rapidly as soon as one group is isolated from another. To this drowned land the name of Sunda Land has been given. It is shown in Fig. 5, and obviously made the journeys of the folk moving towards the Australian areas much easier. There is a somewhat similar but smaller "drowned" land to the north of Australia, which is known as Sahul Land.

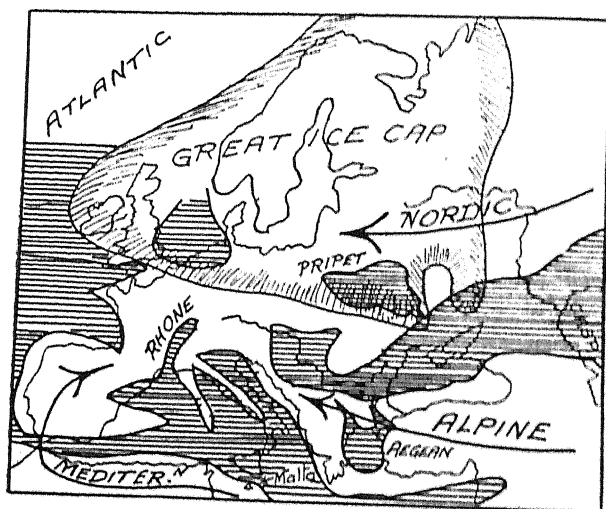


FIGURE 18a.—A composite map showing some of the main topographic changes in Europe during the early human period. The corridors used by the three main European races are indicated. The ruled areas are lakes or seas.

It seems likely that these two lost lands were exposed to the greatest extent during the last major ice age, and that we have here some hint as to when the third great racial migration occurred. For most of the Australoids moved to the south-east, and only a few went to the west. Relics of an Australoid migration are to be found in the south of Arabia, and possibly in the mountains of Algeria (Fig. 20). In this last site Sir Harry Johnston observed Ushtetta tribes, who, in his opinion, probably were akin to the Australoids (Pre-Dravidians) of southern India.

In some period of much warmer climate than during the ice ages,

say in the Riss-Wurm interglacial age, it seems likely that some of these Australoids made use of the Bering Corridor, and so reached the Americas. There are too many non-Amerind skeletons turning up in South America, especially in the vicinity of Rio, for them all to be ascribed to aberrant American Indians! The younger North American anthropologists are prepared to accept some of the evidence for these earlier migrations of Australoids (such as the Punin skull of Ecuador, or the living Qurungua folk of Bolivia); but the older anthropologists still deny the evidence for migrations into America preceding the last ice age.

Many writers on human migrations do not seem to realize the very different conditions which determine migrations of *modern* times. As my good friend Ellesworth Huntington points out, today there is a considerable tendency for the vigorous types to leave a crowded homeland, and cross the seas to start afresh in a region where the opportunities are likely to be more favourable. They know all about these new lands. They can be carried across the world in comfortable steamers, or in latter days by air-liners. Nothing of this kind was present during the slow migrations by *land* in pre-Columbian times, to say nothing of the vastly harder conditions for Neolithic man. In those early days it seems to me that the climatic changes were much more important even than they are today. The world as a whole was under-populated, and wars of aggression were absent or relatively rare.

Let us consider what may have happened many times in the south centre of Asia. It was, during the interglacial periods, a land flowing with milk and honey, from the point of view of primitive man.¹² Here in this cradleland and centre of greatest evolution are relatively large numbers of primitive people. Let us suppose that the climate slowly changes to much worse conditions. Primitive man dreaded the unknown; he would have no incentive to wander in the hope of reaching better lands far away. I picture the strongest tribes maintaining their hold on the best lands in this region, and "*driving the weakest to the wall.*" In this case the "wall" would be the mountain country which surrounds our hypothetical cradle on the south, or the somewhat easier corridors which lead to Europe or to China. Such weaker tribes we may imagine ultimately reaching unstimulating areas of the tropics, or the (in those days) less stimulating marginal lands of Europe and China.

¹²Today it is on the whole semi-desert or desert (Fig. 32), with the result that culture and progress have greatly declined, and a bare subsistence is all that most of the folk in Turkestan and thereabouts can hope for.

Meanwhile good seasons return to the cradleland, and the strong tribes who survived there are again subjected to conditions which promote evolution. During the next long period of advantageous conditions, possibly extending over much of an interglacial period of 100,000 years, this group in turn evolves into a higher racial type. Now comes a major or minor change of climate of considerable duration, and the process of migration and differentiation is repeated.

Such a mechanism would give rise to the series of zones which is indicated in Fig. 17. Lest it should be thought that a personal bias is involved in these anthropometric maps (in Fig. 17), I may add that they are based on the atlas produced by the Italian anthropologist Biasutti,¹³ which I did not see till long after I had arrived at the racial conclusions which I have been demonstrating.

There is one other feature of these migrations which is worth discussion. Obviously the motive force is the drive of the stronger tribes, and of the inclement climates upon the weaker tribes. These are always pushing such tribes out of central Asia. When conditions ameliorate in central Asia, there is no similar factor tending to move the migrating tribes back again. On the contrary, they have now reached habitats which make for slackness and inertia. There are no strong tribes tending to drive them northwards, since by hypothesis the marginal races are weaker than those nearer central Asia. Lastly there are what may be termed land and water "valves," which permit migrations to the south, but tend to bar return traffic. For instance, the long and weary journey from Persia to India by the Khyber Pass is one that would not be re-traversed by weak tribes who had once reached the plains of India, unless very definite pressure was exerted from the south. So also the straits of the East Indies might be crossed by Australoids driven on by stronger enemies in Malaya. But there were no folk to the south who would force them to repeat this terrible passage, and so enable the Australoids to return to their original cradleland.

DETAILS OF THE RACIAL ZONES—THE EARLY RACES

No feature of the classification adopted in this book is entirely new, for the obvious reason that among the dozen latest classifications almost all reasonable methods have been suggested. But it is because the writer has applied the ecological test of the zones and strata,

¹³*Memorie Geografiche*, no. 18, Florence, 1912.

which no other anthropologist has used, and finds that it lends support to one set of racial classes and not to the others, that he adopts the former. (The main physical criteria determining the five races are summarized in Fig. 16). Let us consider the five classes in order of development (Fig. 19). Most anthropologists group the Negritoes as

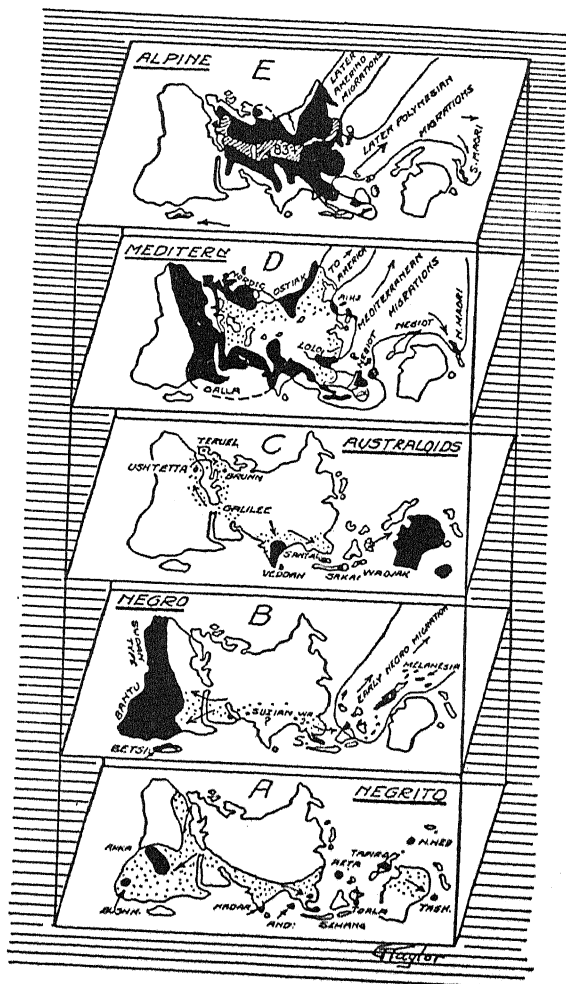


FIGURE 19.—A stage diagram showing the five stages of racial migration in the Old World, each representing a major race. Black areas show present habitats. Dotted areas show probable early habitats. The lowest race in the diagram was the first differentiated; the Alpine the latest.

a stunted variety of the Negro, though Dixon has made them a variety of the Alpine. The writer's belief that they are relics of a very ancient type of man, contemporaneous with Neandertal man, cannot be claimed as proven, but seems to be more in accord with the facts than the other two suggestions.

The writer has shown¹⁴ by means of his "ethnographs" (which correlate five important physical criteria) that the brakeph¹⁵ Negritos of the Congo forest have little in common with the surrounding dokeph¹⁶ Negroes; and the same is true of the Tapiro Negritos of New Guinea and the surrounding Oceanic Negroes. Yet these two far-distant Negrito types very closely resemble each other (Fig. 19 at A). The only link between Negrito and Alpine is the rather broad head of the former. In no other respect are they alike, and there seems to be no evidence, in the general plan of racial migration, which would explain the removal of the Negritos so far from all the Alpines—if they were really an offshoot of the latter. Similarly in Lazon (the Philippines) and in the tip of India (if recent reports on the Kadars are correct) we find numbers of Negritos with no adjacent Negroes from which they could have been derived.

The evidence of *bygone* Negritos is charted (in Fig. 19 at A) in the dotted areas. This shows that in the early days of human development tribes of this race have covered the whole of the southern part of the Old World. The present habitats are shown by the black patches in the map. All these tribes exhibit the typical characters of the Negrito. They are found today primarily in the least accessible regions to the south-east and south-west of the Old World. We could assume that there was one centre of Negrito evolution, say in New Guinea, and an entirely independent one in the Congo forest in Africa. But it is entirely in accord with all the other data of racial migration to assume a single cradleland approximately half-way between the present habitats. This is the explanation of their widespread distribution today, and illustrates to some extent Willis's phrase "Age and Area"; i.e., the older the member of the evolving series the greater the area it will be found to have covered.

All anthropologists adopt the Negro as one of their major classes (Fig. 19 at B). It is almost the sole point of general accord. But the

¹⁴"Ecological Basis of Anthropology" (*Ecology*, vol. xv, no. 3, June, 1934).

¹⁵Brakeph means broad-headed (i.e., brachycephalic).

¹⁶Dokeph means long-headed (i.e., dolichocephalic).

writer has been endeavouring for many years to develop a reasonable theory of Negro origins. As in the case of the Negritoes, we find two far-distant habitats for the Negroes. One of these is in Africa and the other in Melanesia. Many of the older anthropologists seemed inclined to believe that Africa was the cradleland of the Negro, and they assumed that the Melanesian Negroes had migrated around the shores of the Indian Ocean so as to occupy the islands near New Guinea. However, it seems that again we are dealing with a general movement away from central Asia. There is a good deal of evidence for bygone Negroes in south-east Asia; though today, apart from the Semangs of Perak (Malaya), there are no tallish frizzly-haired tribes on the continent. But many of the tribes in Assam and Cochin are described by Guha and Basu¹⁷ as having "crepe" hair, while Mansey has observed Melanesoid skulls from Tonkin. We may certainly accept these facts as proving that Negro tribes flourished in south-east Asia not far back in man's record.

There is some little difficulty with regard to the Australoid race, for it is in a sense intermediate between the Negro and the Mediterranean races. To the layman probably they often look very similar. But since no Australoids have frizzly hair, and indeed none that the writer examined in Australia had even curly hair, it is clear that they cannot be classified with the Negro. In actual fact their hair is wavy, and almost indistinguishable from that of western European people. (It is of interest that Sarasin¹⁸ records that the newborn New Caledonian Negro has wavy hair, which is replaced after the first week or so by the usual kinky Negro hair. So that kinky hair is possibly a secondary character acquired by the Negro folk.) There is a very great variety in the features of the face, some even being leptorhine in the Kimberleys, though the majority have rather broad noses. It is somewhat unfortunate that the well-known books by Spencer and Gillen deal with the aborigines of the heart of Australia. These are much more primitive in appearance than the full-bloods of the eastern or north-west coasts, according to the writer's observations. In the interior of Western Australia I have measured the heads of a number of Australoids with tawny hair.¹⁹ This colour is almost universal among the children and

¹⁷"Age of Man in Europe" (*Anthropos*, 1932, p. 955).

¹⁸See *Proceedings of the Pan-Pacific Science Congress*, Tokyo, 1926, pp. 2386-9.

¹⁹See "New Caledonian Negroes" (*L'Anthropologie*, 1924).

women, but the hair becomes quite dark in the case of the men. No satisfactory reason has been offered for this curious variation.

If we turn to the ecological evidence, then it seems clear that the Australoids (Fig. 19 at C) migrated out of Asia much later than did the Negroes. Thus Mitra²⁰ writes: "India shares with Africa Proto-Negroid beginnings . . . and with south-east Asia the superimposition on them of Proto-Australoid elements." There are now no Negroes on the continent except a few in Perak. But there are millions of Australoids (the so-called Pre-Dravidian tribes) in the eastern hills of the Deccan in India and in Ceylon. So that we may surely say that their less marginal position agrees with the hair character, and places the "wavy" Australoids a little higher in human evolution than the "frizzy" Negroes of Africa and Melanesia.

Many of the people living in western Europe in prehistoric times had skulls closely resembling those of the Australoids. Sir Elliot Smith, the eminent Australian anatomist, informed me personally that a series of skeletons discovered near Brunn in Moravia might have belonged to Australian aboriginals. As suggested earlier, it seems likely that a number of Australoids reached America long before the last ice age. To this migration should be assigned the fairly numerous skulls found near Rio de Janeiro, which the local anthropologists call the *Lagoa Santa* type. I have illustrated a living "Australoid" from Bolivia in my book on anthropology.²¹

THE LATER RACES: MEDITERRANEAN AND ALPINE

The next zone consists of the Mediterranean type with its variant the Nordic (Fig. 19 at D). The English scientist Buxton²² links the Proto-Nordics of north Asia, such as the Ainu, with the Australoids of India, as forming one group—the Primitive Cymotrichous (wavy-haired). While the author prefers to separate the Australoids as an earlier zone, he agrees that the Nordics could have readily evolved in central Asia from the Australoid type. Perhaps the Todas of India and Ainu of Japan are survivors of this peculiarly hairy dokeph type—but with noses much more leptorhine than those of most Australoids.

Many writers since the time of Sergi (1901) have linked the Nordic

²⁰See *Prehistoric India*, 1927.

²¹*Environment, Race and Migration*, Toronto, 1945, Plate II, Fig. 24.

²²L. H. D. Buxton, *The Peoples of Asia*, London, 1925.

and the Mediterranean. Both have wavy hair, and head indices around 78. Sergi considered the Nordics "bleached" Mediterraneans who had moved from Africa into the Baltic region. It seems, however, more likely that Siberia was their homeland²³ in view of the relics in the numerous tumuli (kurgans), and the similarity between the Nordic and early Siberian cultures.

I have in an earlier publication suggested that a dokeph race with wavy hair, developing say in Turkestan, might split into two migrations. One slowly passes through hot arid lands to north Africa, and this environment selects a dark slender type. The northern wing, traversing Siberia to the north-west, ultimately results in the tall, blonde Nordic type. (Possibly a north-eastern branch of these Nordics found its way into Korea or thereabouts, and today survives as the hairy Ainu of northern Japan.) In a later section it will be shown that the blood groups of the Nordics and Australoids (whether A or B isogenes are considered) are of the same character; while as regards the A group, the Ainu also are linked with the other two racial sub-divisions.

As regards the origin, status, and migrations of the Mediterranean race as a whole there is little controversy. Its migrations can be traced back towards southern Asia, both from the European and African "wings" on the west, and from African and Indonesian "wings" on the east (see Fig. 19 at D.) There is no break in the centre as in the case of the Negro and Australoid zones. Indeed India contains many representatives of this race, such as the Kurumbas in the south-west of the Deccan. Indeed the Mediterranean race extends all round the margins of Asia, for there are many tribes of this type, such as the Lolo, still surviving in the rugged ranges of south China where they have not yet been overwhelmed by the Alpine-Mongolian flood.

The zone is more broken along the east Chinese coast of Eurasia than on the west or European side, for two reasons. Possibly the cradleland was nearer the east coast than the west. Moreover, the corridor of egress from the cradleland along the north side of Tibet was (we may well believe) a relatively easy route in the wetter seasons of man's early history. Hence the last "Alpine flood" pressed very heavily on the earlier Mediterranean zone on this eastern or Chinese flank. Shat-

²³G. Taylor, "The Evolution and Distribution of Race, Culture and Language" (*Geographical Review*, Jan., 1921), gives an early and very imperfect picture of the migrations of races out of central Asia into the surrounding continents.

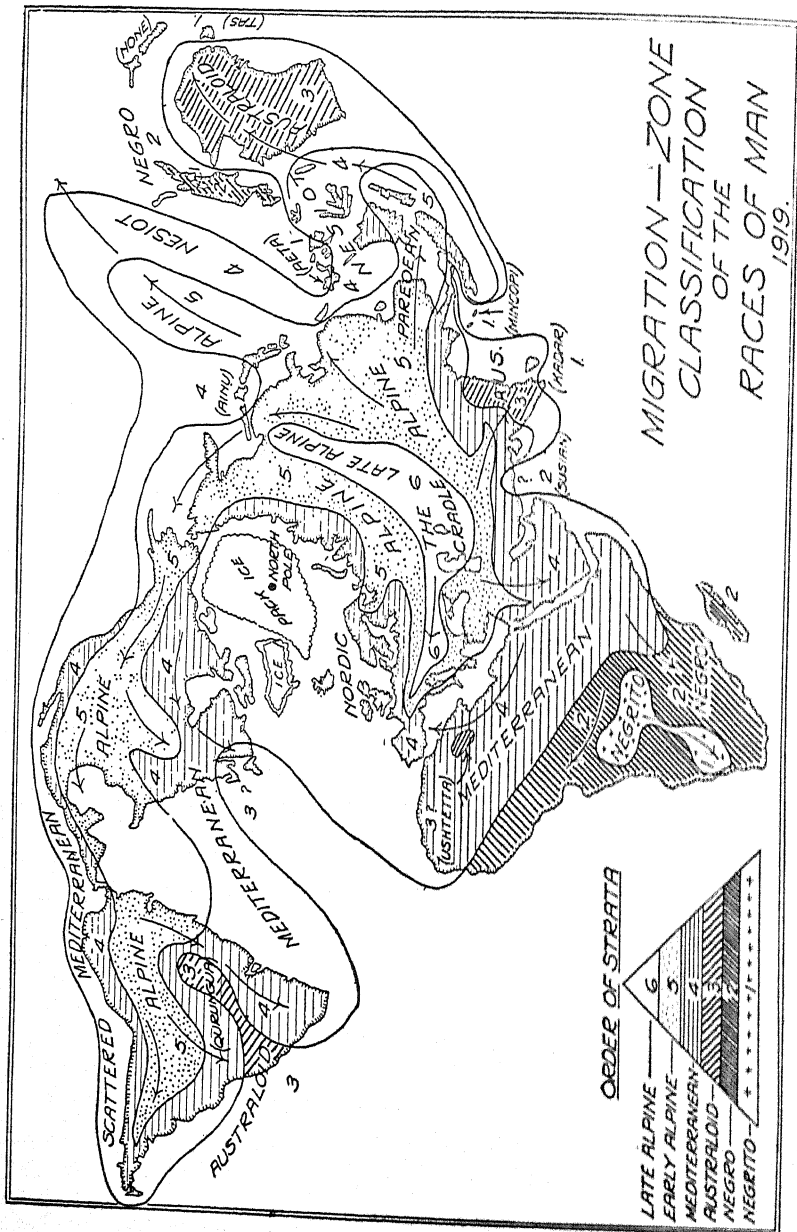


FIGURE 20.—The logical classification of the races of man, based on racial history and ecological principles, as well as on head index, hair-wave, etc. The five major races (about A.D. 0) had spread all over the world. (First published in 1919, and revised in Environment, Race and Migration, Chicago, 1937.)

tered tribes of similar types are found in most of Polynesia, where they constitute what Dixon calls the "Caspian" migration; and the same is true of the American "peninsula" (Fig. 18). Heine-Geldern²⁴ places the cradleland of the allied Austro-nesian tribes in Yunnan, whence they spread through the East Indies.

In India, as Mitra points out (*loc.cit.*), there are clearly several distinct migrations of the Mediterranean race. First came the Dravidian-speakers, who were probably tribes akin to the Ethiopians of north-east Africa. Their descendants are the Kurumbas of the south of India, and possibly the folk who developed the recently discovered civilization at Mohenjo-Daro on the lower Indus. They may have been in control in India from 5000 B.C. until the invasion of the Aryan-speakers from the north-west. The latter were at first mainly Mediterranean (and Nordic?), and perhaps date as far back as 2500 B.C. Later came further invasions from the north-west which probably consisted mainly of Alpine brachycephs. All these stocks are mixed in northern India today, and it is impossible to sort out the racial composition of the early migrations with any accuracy.

It is of the greatest possible significance that the centre of our series of racial zones is occupied by a uniformly broad-headed race (Fig. 20). It is one of the misfortunes of anthropology that its leading exponents originated in western Europe—which is a marginal "refuge-area" in terms of race history. It would be a miracle if folk descended from these refuge tribes were the latest and best endowed specimens of the human race. Unfortunately no miracle has happened; and although we Nordics and Mediterraneans of the "European fringe" have no reason to be ashamed of our later history, I doubt if the scientist of the next century will agree with our naive belief that we must necessarily be the biological elect! If I read ecological anthropology aright, that position (for what it is worth) can best be claimed by the central belt of very broad-headed folk who extend from central France to Manchuria (see Fig. 20). This conclusion will readily be adopted by any student who accepts the implications of the Zones and Strata theory.

The four small maps shown at the foot of Fig. 22 indicate fairly closely the characteristics of the Alpine peoples. First of all, they have very broad heads, the breadth ranging from 80 to 90 per cent of the length of the skull. Secondly, the nose is moderately leptorhine (i.e.,

²⁴"Anthropology of Yunnan," (*Anthropos*, 1932).

narrow), though on the margins the presence of some Australoid blood makes it somewhat flatter. Thirdly, the face is rather a broad one. The hair is usually straight or faintly waved (as shown in the left-hand map, Fig. 17). The hair is dark brown or black; and the skin colour is white or light brown with a strong yellow tinge in the north-east. The stature is moderate (from 59 to 66 inches) throughout all the vast area of the Alpine peoples.

Any unbiassed scientist will agree that all the usually accepted criteria have been considered in this list. Yet most anthropologists are quite satisfied to follow the unwarranted division of these peoples into two entirely distinct races: the western *Caucasian*, and the eastern *Mongolian*. If criticized, they state that in the east many of the folk show a slight fold in the eyelid, while others have queer shovel teeth, and blue spots on the buttocks! It is true that these are not found among the western "Caucasians"; but there seems no reason to use such trivial characteristics to separate two major races of mankind, and therefore it seems logical to unite the Mongols with the Alpines. (These faulty classifications will be discussed further in the next chapter, where the racial relations of the American Indians will also briefly be considered.)

The following quotation from an article by a conservative anthropologist, R. R. Marett of Oxford, is relevant to this discussion. In the article on "Anthropology"²⁵ he comments on the theory of zonal migrations and classifications of race given in the present volume, and he goes on to say: "Put forward as it is without dogmatism, the scheme may be cited as an instructive attempt to view human history as a whole from the angle of the anthropo-geographer. After all it applies to man a method of zoning which the biologist has applied to the distribution of all other forms of life with considerable success." Surely a theory becomes almost orthodox when it is accepted in the *Encyclopædia Britannica* to such an extent!

²⁵*Encyclopædia Britannica*, 14th ed., 1929.

CHAPTER IV

RACIAL CONTROVERSIES AND RACIAL MIXING

RECENT RIVAL CLASSIFICATIONS

In the last twenty years there have been a number of attempts to classify the races of man, besides that of the present writer. It will clarify the issue somewhat if we discuss some of the major differences of opinion illustrated by four or five of these classifications. The basis of the writer's classification is his migration-zone scheme, which in

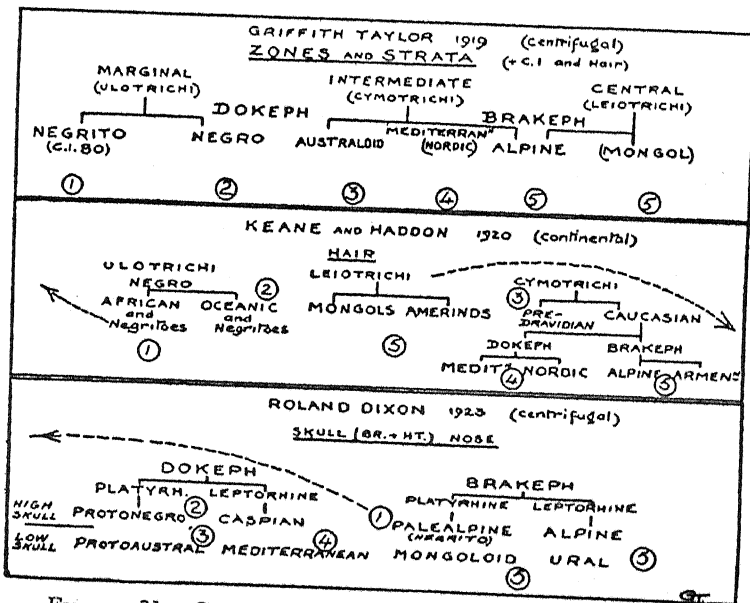


FIGURE 21.—Comparative outlines of three racial classifications, showing the main criteria adopted by Keane, Haddon, Dixon, and the writer.

turn depends on the Zones and Strata theory. Essentially it is a biological grouping, quite close to that used by Matthew for the higher mammals, and checked in the same way by an appeal to the historical or fossil data.

This method is shown diagrammatically in the top chart in Fig. 21.

The five major races are indicated by the five numerals at the foot of the chart. The geographical arrangement is emphasized, since it is pointed out that the Negrito and Negro are always marginal; the Australoid and Mediterranean are intermediate; while the Alpines have a central position among the various zones. This seriation agrees fairly well with the character of the hair; which is shown by the order of the terms *Ulotrichi* (frizzy), *Cymotrichi* (wavy), and *Leiotrichi* (straight). So also the head indices proceed from the narrow-headed (dokeph), marginal races to the broad-headed (brakeph) Alpines. The aberrant position of the Negritoes in this respect has been discussed earlier.

Turning now to the classes of Roland Dixon, which are shown in the bottom chart of Fig. 21, we find that he also postulates a centrifugal movement of the races from Asia. His maps of 1923 are not unlike those of the writer published in 1919. However, he also stresses the height of the skull and the breadth of the nose. There are two major differences from the writer's scheme. Dixon allies the Negritoes with the Alpines on what seem very insufficient grounds to the writer (see p. 70). He also splits the Alpine and Mongolian types, calling one variety of the former the Ural race. We will return to this last point when we have considered two other methods of classification.

The middle chart in Fig. 21 summarizes the scheme of Keane and Haddon, two English writers who published their method in 1920. Here we find the character of the hair made perhaps the chief criterion, but again the two unwarranted terms Caucasian and Mongolian are used for two major races; which essentially are but varieties of the central (Alpine) race of the Old World. Keane and Haddon also group the Negrito as an aberrant form of the Negro. The numerals in these two charts are the same as those used in the top chart, and so the positions of the five races can be readily compared.

So far we have considered classifications by Australian, American, and English researchers, but by far the most elaborate study of race differentiation, etc., has been produced by a German. The book, by Egon von Eickstedt, *Rassenkunde und Rassengeschichte der Menschheit* appeared in 1934,¹ and in general it is an admirable volume. But von Eickstedt is content to accept the early classes of Blumenbach and Cuvier, though he varies the names slightly. He divides human beings into four main divisions according to the continents, though in his book he gives plenty of instances of overlap. His four classes are

¹Stuttgart, 1934.

Europide, *Mongolide*, *Amerikanide*, and *Negrade*. These again are split into smaller groups, which he calls "series"; while each series in turn is sub-divided, giving a total of about sixty "varieties."

The main map in Fig. 22 is traced in outline from that given by von Eickstedt. It is unsatisfactory, since it is split along the Pacific; and so the Bering Corridor is not shown. Thus the map masks the real connection between the Amerind and Asiatic peoples. Only in the case of the large *Negrade* division is a major ethnic area at all satisfactory in the writer's opinion. Many anthropologists now object to any wide

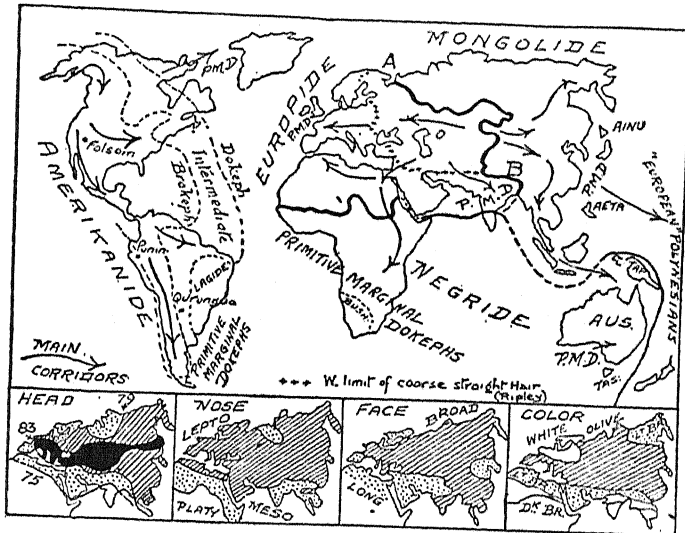


FIGURE 22.—A world map showing von Eickstedt's four main racial classes; the remaining data support the alternative classes proposed by the writer. The four small maps demonstrate the inadvisability of separating Europeans and Mongolians as major races. (P.M.D. means primitive marginal dokephs.)

separation of the Amerinds and the adjacent Asiatics. Further, even though a similarity between the European types in the west and the Ainu and the Polynesians in the east is admitted in von Eickstedt's discussions, this is not indicated or explained in his main racial maps.

However, the main objection to all three of these classifications is that the broad-headed Alpines of Europe are lumped in with the biologically very different Mediterraneans and Nordics to form the *Europide*, while the peoples of eastern Asia are erected into an entirely

distinct race called the Mongolide. In a word, as stated earlier strong exceptions can be taken to von Eickstedt's line marked AB in the main map (Fig. 22) extending from the Arctic Ocean near Finland to the Indian Ocean near Calcutta.

All students of human migration must admit that there have been age-long westward and eastward migrations across Asia in the region of the Tarim basin (see arrows in the main map, Fig. 22). As a result the anthropological isopleths (i.e., lines of equal abundance) are concentric about this corridor in central Asia. This is shown in the four maps of head index, nasal index, face breadth, and skin colour; all of which are derived from Biasutti's independent atlas.² The character of the hair is also charted (by crosses) in the large map in the figure.

If there were a real racial difference between European and Asiatic peoples, then the isopleths would run parallel to the line AB (Fig. 22); whereas in the four small maps they run at right angles to this line, i.e., they are concentric with the coasts. Hence AB does not separate biological areas so far as the four very important criteria named are concerned. It will be seen later that the blood groups offer the same concentric type of isopleth, and prove that there is no racial difference between the so-called "Caucasian" peoples of Russia and the "Mongolians" of China. This may be taken as support for the old adage "Scratch a Russian and find a Tartar." But in reality all the folk of central Europe (including those of central France) are relations of the brakeph Chinese (Fig. 23).

The error is largely due to the fact that anthropology started in western Europe. If only Avicenna—the famous Arab physician who flourished in Bokhara in central Asia (Fig. 32) around A.D. 1000—had given his attention to the anthropological characteristics of the surrounding nations, he might have produced a much more scientific classification of the broad-heads than have Cuvier, Blumenbach, Haddon, or von Eickstedt! He would have decided, I daresay, that the tribes around Bokhara were the latest and finest specimens of mankind, just as most other writers naively decide regarding their own kind! (But I think Avicenna would have been in the main right.) Then he would have pointed out that there was a slight change in the facial appearance of these broad-heads as one moved further to the west or to the east. He would have talked of the "European" variety of brakephs and the

²*Memorie Geographiche*, no. 18, Florence, 1912.

"Chinese" variety of brachycephals. He might even have gone further, and suggested that centuries hence, when the people of Eurasia were all finally mixed together, they might form an Old World race not very different from what we see today in the central parts of the U.S.S.R. It is inconceivable that he would have made one of the major boundaries of the human family run north-south through Bokhara; yet that is practically what is suggested by almost all anthropological classifications, except those put forth by Dixon in 1923 and myself in 1919.

RACES AND BLOOD GROUPS

We shall do well to consider a new method of approach to the racial problem. Around 1900 Landsteiner investigated the differences in the bloods of normal individuals, and discovered the main groups. There are four types, which are identified somewhat as follows. If the red corpuscles of an individual are mixed with the serum of folk of the same "blood group," the suspension remains unaffected. If, however, the serum belongs to another "blood group," the red cells will come together in clumps. This is called *agglutination*. It depends on reactions between two substances, one in the cells and the other in the serum. These substances are probably complex proteins.

The four blood groups are known as A, B, AB, and O. The serum of A agglutinates the corpuscles of B, and vice versa. In the third group the cell suspension may be agglutinated by both sera, in which case the blood group being tested is AB. Lastly the corpuscles may be affected by neither serum A nor serum B, in which case they belong to group O.

In 1930 the writer published a map³ showing that the blood groups of the Nordic and Mediterranean folk were somewhat alike, and differed very materially from those of folk occupying the central portion of the Old World, i.e., the Alpines. The problem has been studied by a number of human biologists in the last decade. In the recent book by F. Schiff and W. C. Boyd entitled *Blood Grouping Technic*⁴ two maps are given showing the distribution of the A and B groups for the whole world.

The map representing the distribution of the B blood group is satisfactory from the point of view of the drawing of the isopleths; but the map for the A group seems to the writer to be unnecessarily com-

³"Racial Migration Zones (*Human Biology*, vol. II, no. 1, 1930, p. 54).

⁴New York, 1942.

plicated, even granting that the data are rather sporadic. In Fig. 23 the lines (isogenes) have therefore been redrawn in what seems to a geographer to be a legitimate reconstruction of the data given (on p. 204) in the book cited.

In both cases we see that there are two poles of distribution centred in Europe and Australia respectively. Thus the A groups are exceptionally numerous in these marginal areas; while the Indian Ocean bounds coasts with distinctly low values for A group folk. It is important to note that the main mass of Asia is inhabited by peoples with an intermediate number of A group folk; i.e., this group is neither very abundant nor very rare.

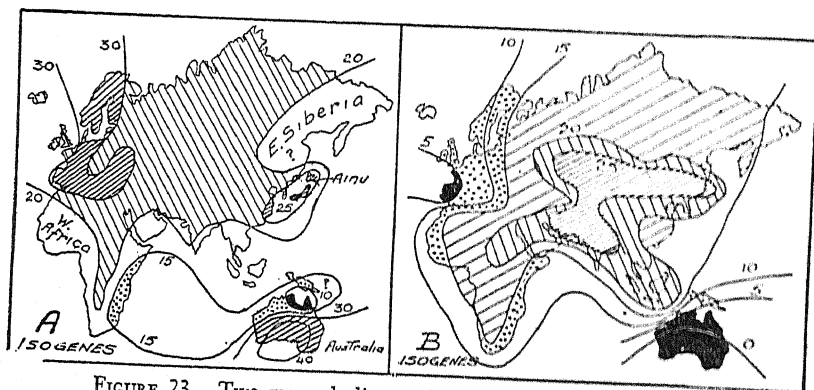


FIGURE 23.—Two maps dealing with human blood groups A and B. (Redrawn from data given by Schiff and Boyd.)

In the case of the B group there is a clear indication that among the peoples of central Asia (i.e., those called Alpines in the present book) there is emphatically a high percentage of the B type. The area with a strong preponderance of the B group (labelled over 25, with close ruling) suggests some characteristic especially common in the central Asiatic region and spreading along the Tarim Corridor into China, as well as extending down into Persia and the north of India. These are almost precisely the migrations of the later evolved peoples of the Old World, if the thesis advanced previously is correct. As mentioned earlier there may be a real anthropological kinship between the primitive folk of Europe and the Australian aborigines, which is corroborated by the similarly low proportions of the B blood group in these two marginal areas. Further than this the writer is not disposed to go.

The tables of blood groups given by Alexander S. Wiener in his latest edition of *Blood Groups and Transfusion*⁵ contain many data which show that this method of attacking racial relationship is only in its infancy. For instance the Samoans and Tahitians are close relations, whatever anthropological criteria are considered. Yet Stevenson gives the following figures for the Samoans; while Shapiro's data for the allied Tahitians are entirely different.

	Persons	Per cent A	Per cent B	Per cent O
Samoans	500	17	19.4	58.6
Tahitians	124	59	4.8	35.5

In the same way there would seem to be no reason why the Czechs of Bratislava should differ from those of Brunn only eighty miles away. The writer would class them both as Alpines, situated well away from any important race-transition area. Trokan gives the percentage of A group as 52 for the former city, while Suk gives 44 per cent for Brunn. As regards the Australian aborigines various researchers give the A group as ranging from 32 to 66 per cent; which seems rather a large difference for a group which most anthropologists accept as belonging to one unit. For these reasons it would appear that we must await further research before we use blood groups as an accurate test of race; though again it is worth noting that the supporter of the Caucasian-Mongolian fallacy can gain no support from blood grouping. None of the isogenes (in Fig. 23) agrees with the line AB in Fig. 22.

WHERE DO THE AMERINDS STAND?

From the point of view of the distribution of man, the outstanding fact in America is the close approach of the continent in the north-west to the huge land mass of Asia. All authorities agree that the cradleland of the later races was in Asia, so that all the primitive peoples of America arrived by way of the Bering Corridor. Here in the extreme north-west of the continent there is a gap in the land connections which is only forty-six miles across. There are, moreover, several small islands which act as "stepping stones," and in the winter the whole strait is frozen. We are quite sure (from the distribution of such animals as the Mountain Sheep and Goats) that movements from Asia to America

⁵Third ed., Springfield and Baltimore, 1943, pp. 297-304.

have often occurred in this region; so that it would be surprising if primitive man did not follow his prey over this corridor, or in times of stress, say when attacked by stronger tribes, did not seek refuge across the Bering Straits from Asiatic enemies. Indeed, we have evidence that primitive Asiatic tribes often crossed to Alaska before the Russian occupation of Alaska in 1784.

No American anthropologist doubts that the aborigines of America (the Amerinds) entered by this route. So also did that very interesting group the Eskimo, who are not physically very different from some of the earlier Amerind tribes. But when we come to examine the Amerinds as a whole we find that they show a tremendous range of physical characters. This led the writer in 1919 to the belief that the main bulk of the Amerinds from the eastern margin of Asia very closely resembled the main bulk of the tribes who moved out of Asia on the western side, i.e., the numerous Mediterranean and Alpine folk of Europe. Another interesting parallel is that both in Europe and South America we find a considerable number of fossil skulls, which are like those of the Australoid race, rather than like any of the numerous Amerind varieties of skull. Indeed in Bolivia the so-called *Qurungua* folk,^a who are still alive, have many of the facial characters of the Veddahs of Ceylon, who are Australoid.

The original idea that the Amerinds are all characterized by a reddish skin has long been abandoned, though this idea is preserved in the familiar name of "redskin." What are the main physical features of the Amerinds? They all have wavy to straight hair without any sign of frizziness. The head index varies greatly, from 83 for the Plains Indians (of the United States) and Patagonians to 74 for the narrow heads of the Algonquins, etc., of eastern Canada (Fig. 20). Even narrower are the heads of many of the inland tribes of Brazil. The width of the nose is usually moderate; though there seems to be a tendency for broad open nostrils among the tropical Amerinds, and for narrow (leptorhine) noses in the cold lands inhabited by the Eskimo and Patagonians. Stature also varies very greatly, and often in the same way as does the nasal breadth. The tropical Indians are usually very short, while the Patagonians are some of the tallest people in the world.

If we try to reconstruct the migrations of the Amerinds, we see a picture something like the following, in the writer's opinion. In the

^aSee the photograph of *Qurungua* man on Plate II in my *Environment, Race and Migration*, Toronto, 1945.

last interglacial period—more than 50,000 years ago—temperate America was possibly warmer than it is now. Some of the primitive tribes of north-east Asia (rather like the Australoids of the southern margin of Asia today) wandered across the Bering Straits, following their prey. They were cut off from Asia by the oncoming cold of the last major ice. Then about 20,000 years ago the Bering Corridor again became a fairly accessible route, and the marginal narrow-headed folk of north-east Asia poured into Alaska, etc., in large numbers. (They had been driven to the north-east by the growing populations of the broad-headed Alpines of China, Manchuria, and eastern Siberia.) This second migration wandered south into America along the most accessible corridor, i.e., probably down the eastern margin of the Rockies. They killed or drove forward the few Australoids whom they may have come across; and gradually reached South America and the eastern sections of Brazil.

Lastly came the dominant Amerinds, who are in general much broader-headed. They were the ancestors of the Sioux, Shoshone, Pueblo, Quichu, and Patagonian Indians. They also first spread along the main continental corridor, i.e., along the rather open country which lies just east of the Rockies, or near the eastern margin of the Andes in the southern continent. It may be assumed that their migrations are so recent that they have not yet spread very far from the easy corridor. For this reason the eastern Amerinds—such as the aborigines of New England and of the Canadian Maritimes—who were the first known to Europeans in the northern continent—are biologically among the most primitive, and culturally by no means the highest of these very interesting types of mankind.

The divisions given in the world race map (Fig. 20) illustrate these geographical data. I show some relics of a very early Australoid migration in Brazil and thereabouts. This region is a "refuge-area" as regards folk entering the continent by way of Alaska. Then the eastern coastlands are inhabited by the earlier Amerinds, who are best thought of as a variety of the Mediterranean race of the Old World. Everyone knows that they are much more like the European marginal people than the "Mongolian" variety of the Alpines, who now inhabit most of eastern Asia. Lastly we find the American representatives of the Old World Alpines inhabiting the land corridor in the New World. (They have not yet had time to spread all over the New World.) They also are more like the marginal (European) Alpines than the nearer Alpines

now living in China, Manchuria, etc.; since like the former they were originally a marginal Asiatic group themselves.

All along the Pacific coasts—in general, rugged and unattractive to primitive folk—we find scattered early Mediterranean tribes pushed into these refuges by the ingress of more powerful Alpines. It is clear that in these migrations into the latest continent to be settled by primitive man, the key to the distribution lies in the varying environment. We may be sure that the still earlier migrations into Africa, etc.—which occurred so long ago that the data are scarce—were determined by similar environmental principles.

RACIAL MIXING

Few subjects have caused so much controversy as the mixing of races. Popular opinion varies tremendously, so that one could produce a very interesting map to show the grades of intensity of feeling in this matter in various parts of the world. A first approximation to such a map appears as Fig. 24. I suppose opposition to racial intermingling

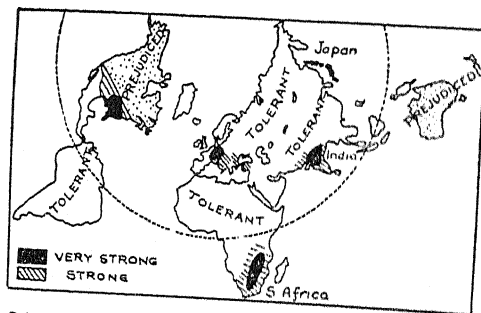


FIGURE 24.—A tentative map to show where race prejudice is strong.

is most intense where there is a majority (or a large minority) of "coloured folk" living in close association with the so-called "white" race. We find this in the south-east states of the Union, and in the south of Africa. In both these cases the under-privileged group consists of Negroes; who as explained earlier have not yet had the chance to prove what they can do in regard to human progress. Everyone knows of the brilliant contributions made in the past by Negro-white half-castes such as Booker Washington, Frederick Douglas, and Burghart Du Bois.⁷ As stated earlier we must suspend judgment until this race

⁷See J. W. Gregory, *Menace of Colour*, 2nd ed., London, 1925.

has dwelt for a number of generations under conditions as satisfactory for human progress as those enjoyed by other races.

The writer has no hesitation in asserting his belief that there is no obvious biological objection to race mixture among groups such as the Europeans and the later-evolved races of Asia, north Africa, Oceania, and America. (Needless to say, there are many cultural objections, but these are due largely to anthropological ignorance, which one hopes will die away as the public becomes more widely educated.) My reasons for this statement are that precisely similar crossings of brachycephals and dolichocephals, of tall and short, of fair and dark, etc., etc., have been going on for countless centuries in European regions without anyone talking of biological deterioration. No French Alpine from the centre of his country (Fig. 19) worries whether his bride is another French Alpine, or a French Nordic, or a French Mediterranean. Yet these race mixtures are similar to those which occur when a northern Chinese (an Alpine) marries, say, an English woman from Devon (a Mediterranean) or a woman from Norfolk (a Nordic).

My "White Australia" opponents in Australia, where I first published these heterodox views, would say: "Would you let your daughter marry a Chinese?" My answer would be to the effect that if she had to live among the usual Chinese or Australian surroundings—where complete ignorance of the actual biological results of racial mixing is universal—then I should be much averse to such a marriage. But only because of the great social difficulties which the European girl would have to meet. I am sure that the picture will be very different in a few generations.

The simplified map (Fig. 24) suggests that racial tolerance is happily widely spread over the earth. British, Americans, and Germans, have been the worst offenders in this respect. I believe from what I have seen in China, and heard concerning India, that if less of the unwarranted "pride of race" felt by the British officials were flaunted before the educated Indians, our political control in such regions would be very much firmer. I have suggested this intolerance by the ruled area in India on the map. Probably race prejudice would be quite as strong there as in the southern United States or South Africa if the economic conditions were of a similar nature. I shall deal with the intolerance to Jews in the next chapter.

It is illuminating to see that Japan has similar ideas about racial superiority. In Hawaii, L. C. Dunn reports, the Japanese, who com-

prise over 50 per cent of the population of the islands, are playing almost no part in hybridization, since they feel superior to the other groups. Out of 7,671 marriages of Japanese men in Hawaii, only 44 (or less than 0.5 per cent) were with persons other than Japanese. Marriages between Chinese and Hawaiians are frequent, and are producing a cross which is being watched with great interest by sociologists. Most observers agree that there is no deterioration as a result of such crossing.

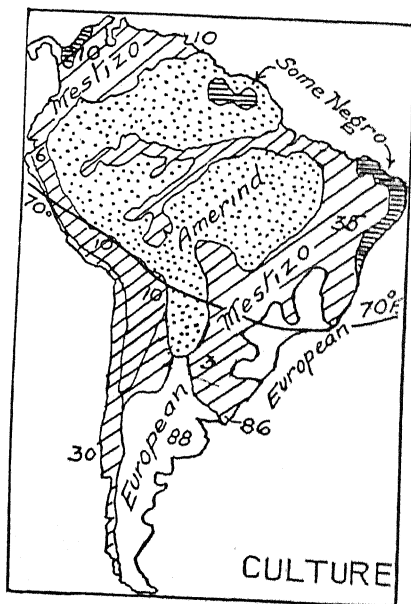


FIGURE 25.—South America, to show the chief regions of European, Mestizo, and aboriginal (Amerind) culture. Figures show percentage of Europeans. (Based on C. F. Jones.)

However, it is but fair to record that J. A. Mjoen who has worked on the crosses of Norwegian Nordics and (Alpine) Laplanders is of the opinion that the half-caste in such cases is inferior to the parent. How he can reconcile his results with similar crosses that have been going on through the ages in the rest of Europe—without evil results—I am unable to say.

In South America is the world's great laboratory of racial mixing. In 1913 Lord Bryce wrote as follows in his book on South America: "The doctrines of human equality and human solidarity have here their

perfect work. The result is so far satisfactory that there is little or no class friction. The white man does not lynch or maltreat the negro . . . the negro is not accused of insolence, and does not seem to develop any more criminality than naturally belongs to any ignorant population with loose notions of morality and property." Further he adds: "The Mestizo in Peru is not palpably inferior to the Spanish colonial of unmixed blood, but seems to be substantially his equal."

Where the Spanish or Portuguese controlled settlement race prejudice never became violent. To a less degree the same is true of the French. But in north Africa we are dealing with a Moslem region; and one great merit of that religion is that human brotherhood cuts across racial lines in a way that is almost unknown in many Christian countries. In the Soviet lands racial intolerance is actually officially frowned upon, and the under-privileged peoples are making enormous strides forward, now that the social restrictions have been largely removed. I have accordingly marked these regions "tolerant" in Fig. 24. Naturally in the bloc of Asia-controlled countries from Anatolia to China, European "pride of race" is of very little importance. Curiously enough it is this group of peoples in Turkestan, north China, etc., who have some claim to the title of the latest-developed type of man (Fig. 20).

It has sometimes been claimed that the progress of the South American republics is inversely proportional to the percentage of Mestizoes. There is no doubt that there is a correspondence of this sort, but it is more likely to be due to environmental control than to be the result of race. The following table based on Clarence F. Jones (*South America*), is worth discussing in this connection. The map given in Fig. 25 also comes from this book.

Country	Amerind	Mestizo	European	Illiteracy	Temperature
A Paraguay	97 per cent	*	3	88	71° F.
Ecuador	65	23	6	84	70° on plateau
Bolivia	50	40	10	80	70° on plateau
Peru	50	35	10	78	70° on plateau
Colombia	15	40x	10	82	80°
Brazil	15	30x	35	80	75° to 80°
B Chile	5	65	30	60	40° to 60°
Uruguay	2	12	86	40	65°
Argentina	2	10	88	35	40° to 60°

*Mestizoes are included with Amerinds.

xColombia has 35 per cent and Brazil 20 per cent with Negro blood.

We can gain some idea of the relative progress towards civilization by the column giving approximate illiteracy figures. Brazil is so huge a country (3.2 million square miles, and therefore much larger than the United States) that these figures should be given for its major provinces to be comparable with the others. It is clear, however, that three South American countries in the B group are much ahead of the others in the A group. These progressive countries arranged in order are Argentina, Uruguay, and Chile. The main reason for this is in all probability the fact (suggested in the last column) that they are the sole temperate lands. This type of climate makes for progress, and, of course, is the main reason why Europeans have flocked there in large numbers. It is true that the plateau countries—though situated within the tropics—have relatively cool climates around 70° F. But here again the environment is adverse, since no elevated land is likely to have the wide fertile plains, suited for the best agriculture, which cover large areas in the three progressive countries. It should be noticed that the cooler state of Chile is progressive, though it has a large proportion of Mestizoes.

RACIAL MIXING IN AUSTRALIA

In 1921 the writer began the first lecture courses concerned with racial geography in Australia. During the next few years he made a number of journeys to study aborigines, especially in regard to the way in which the primitive culture was amalgamating with the European civilization. His chief studies concerned the Kamilaroi tribes of northern New South Wales, and the scattered tribes in the vicinity of Lismore on the north coast of the same state (Fig. 27). Later the interesting group of Chinese-Australoid half-castes near Camoowcal in north-west Queensland was visited. Finally, in the summer of 1924-5 a number of the aboriginal tribes in the central west of Western Australia were investigated. I quote largely from a paper "Kamilaroi and White" by F. Jardine and myself.⁸

Today the 60,000 full-blood Australoids are almost all found along the north coast of Australia, i.e., the region farthest from the cooler lands of the south and south-east where the British settlement is largely concentrated. In Tasmania the last "Tasmanian" died in 1876, but these aborigines were almost certainly crossed with a good deal of

⁸"Kamilaroi and White" (*Journal of the Royal Society of New South Wales*, vol. LVIII, 1925).

Negrito blood. The proportion of half-castes (i.e., with Europeans) to full-bloods varies directly as we proceed north. The figures for the various states are as follows: Victoria, 9.4 to 1; New South Wales, 9 to 1; South Australia, 1 to 1; Queensland, 1 to 2; Western Australia, 1 to 5; and Northern Territory, 1 to 19.

At the time of our survey of the half-castes and full-bloods at Angledool, Pilliga, and Walhallow in north central New South Wales (Fig. 27), it was not too late to gather the history of the race mixing. Today it would certainly be too late in these places. Even in 1923, none of the children remembered any native words, and only one old lady was able to tell us some of their riddles.

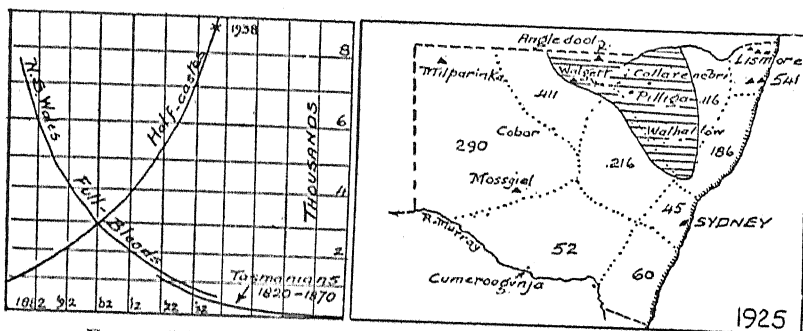


FIGURE 26.—The extinction of the Australoids in New South Wales, and of the Tasmanians. The corresponding increase in half-castes shows that a merging with the "whites" is taking place.

FIGURE 27.—The distribution of the full-blood Australoids in New South Wales in 1925 in various police districts. The area of the Kamilaroi tribes is shown ruled. Places with more than forty full-bloods are shown by triangles.

It must be remembered that these southern Australoids were almost the least cultured tribes on earth, when they were first discovered by the white settlers in 1788. Although in the writer's opinion their *biological* position was half-way up the "racial tree" (i.e., between the Negroes and Mediterraneans), yet their isolation for several thousand years from any of the more cultured folk to the north, left them far behind the most primitive Negritoes of New Guinea in regard to arts and crafts. They had no pottery, no metal, they grew no crops. Their weapons were even of the rough Paleolithic type in places, though in the north and elsewhere their stone axes were ground. They had domestic dogs, and could construct sapling huts (or wurlies). Their chief "monument"

(as far as is known to the writer) was the series of stone fish-weirs built in the shallows of the Darling River near Walgett. These low walls were repaired after floods, and showed a most untypical thought for the morrow's food.

The aborigines in New South Wales live mostly on Reserves, each of about 300 acres; though there are several, as at Brewarrina (4,700 acres) and Cumeroogunja (2,500 acres) which are much larger (Fig. 27). The aborigines live in galvanized iron houses, each costing (in 1922) about \$500. There is usually a school and a manager's house at one end of the Reserve. The children are sent to school when they reach five or six years of age, and spend about five hours a day on tasks not unlike those of the white children of the same age. As the boys grow older they accompany the men to the neighbouring towns or ranches. In most cases the young men soon learn to hold their own at jobs which do not make too great a demand on their perseverance. Shearing, droving, horse-breaking, scrub-cutting, carting, and similar work appeal to them most.

The welfare of the older girls is maintained by apprenticing them among the surrounding ranches as servants or nurse-maids. Rations and clothing are issued regularly to the aged, to invalids, and to the women and children.

In the original paper cited above,⁹ many data are given as to the variation in mentality and physical characters with the variation in the "white" and "black" blood. It seemed to be accepted that the blacks at the age of fourteen were about as intelligent as white children at the age of ten. The primitive folk lose their mental initiative about the age of thirteen or fourteen, and the boys go off rabbiting with dogs and traps, instead of attending school.

A few notes on the language and transition customs may be of interest. Here are specimens of what may well be one of the earliest language types, preserved in the world. The sentences represent an aboriginal riddle, in which one guesses the animals speaking. The first asks the question as follows:

Koombai, Koombai Minyi-gindah, ngarral-dunnah dillay-dillay?
(Comrade—How can you see from the side?)

The second answers in the following words:

Nindiganni Minyi ngarral-dunnah mooyoi-mooyoi.
(And how can you see looking from the nose?)

⁹"Kamilaroi and White," loc. cit.

Answer to riddle: The crayfish (Ingah) is talking to the crab (Nullahgah).

The aboriginal cemetery near Collarenebri illustrates in a notable way the transitional period between aboriginal culture and white civilization. The cemetery is enclosed in a neat netted fence, and contains an area of about 400 square yards. The graves number thirty-three, and are not regularly disposed with regard to east and west. Each grave is usually marked out by four poles laid on the ground. It is the covering, however, which arouses attention. Every grave is ornamented by brightly-tinted crockery and glassware. Broken bottles and tumblers form the margin, while all the intervening space is filled with a jumble of broken glass and china, like a loose mosaic. There are cruets, decanters, medicine bottles, and copper coins. On several graves, small frames, like kite-frames, are ornamented with beads, and reminded us of some of the central Australian "regalia" for local ceremonies. On a baby's grave lay a feeding bottle. We were informed that the aborigines like the police sergeant to read a service at the grave. When I visited it the place was kept in order by several old aboriginal women. At times they removed all the crockery, washed it and replaced it on the graves. Probably this interesting transition "exhibit" has now been scattered to the winds with the death of the old women. In the original paper over fifty photographs of full-bloods, half-castes, and other types of "breeds" are presented. Data as to the changes in physical measurements with access of "white" blood can be consulted there, if desired.

It will be noticed from the graphs given in Fig. 26 that it is not quite correct to speak of the extinction of the Australoids in New South Wales. What is happening is that the proportion of half-castes increases as the full-bloods decrease. Since there are over seven million whites and only about 60,000 full-bloods on the whole continent, there can be little doubt of the ultimate result. The population of aborigines is so small that the vast majority of the Australian people hardly know they exist. Hence the economic rivalry which produces much of the race prejudice in other lands is non-existent. The prejudice in Australia (i.e., the white Australian policy) exists against the so-called yellow race, primarily against any increase in the number of Asiatics allowed into Australia. In 1933 there were about 9,000 Chinese and 2,000 Japanese on the continent, but very few of these were women.

One very notable centre of Japanese settlement in Australia before the war was at Broome in the far north-west. Here is a little town

which had about 3,000 inhabitants when the writer surveyed it in 1923. Of these about 1,200 were Japanese, and about the same number were Koepangers from Timor. Only about 600 in this town in "White Australia" were British! The reason was economic. The pearling trade would vanish if it were left to the white Australians to supply the crews. Usually there is a white skipper, two Japanese divers, a Japanese engineer, and several sailors from Timor. These "coloured" folk are bound by law to leave Australia later. No doubt the trade has greatly diminished since the war started, but the writer has no accurate data on this point.

IS THERE A SUPERIOR RACE?

We Europeans are familiar with the term "Yellow Peril," with its connotations that our civilization is menaced by vast hordes of underpaid workers from the east of Asia. This problem is essentially an economic one, but the reference to colour suggests that to the ignorant layman, race (i.e., biological inheritance) is involved. It is salutary to realize that many of the millions in the Orient have little admiration for our civilization; or, as regards "race," for the "salmon-coloured hatchet-faces" as they describe our more or less ruddy complexions and elongated faces.

This type of controversy will die out as it is realized that the people of eastern Asia are built up of much the same stocks as the folk in Europe. One of the most important results of the racial classification advocated in this book is that it shows that much of the biological gap between "East and West" (as advocated by the pronounced Imperialist) has little or no scientific basis. Nevertheless in Europe itself there is a biological difference between the brachycephalics and the dolichocephalics, while the latter have numerous minor biological distinctions from the short, dark, slender Mediterraneans. Can we show that there is any endowment of physique or talents which sets one of these three races above the other? We shall return to this problem later in dealing with the nations of Europe. Here the broader aspects of race superiority will be considered.

A number of years ago a famous American publicist aroused much interest by his "Summary of the History of the United States in 500 Words." It has seemed to the writer possible to summarize the history of the world in three words, as follows: "Centrifugal Alpine Expan-

sions." The mere fact that the inner portion of the Old World is completely occupied by brachyceph Alpines, with a restricted and often broken border of Mediterranean and earlier races, is sufficient to prove that age-long pressure by the broad-heads has been the outstanding racial characteristic of Europe and Asia. Much the same thing is true in America, as demonstrated earlier. If we realize that pressure on the intermediate races is inevitably handed on to the marginal primitive folk, then it is true that Alpine expansions in Asia and east Europe

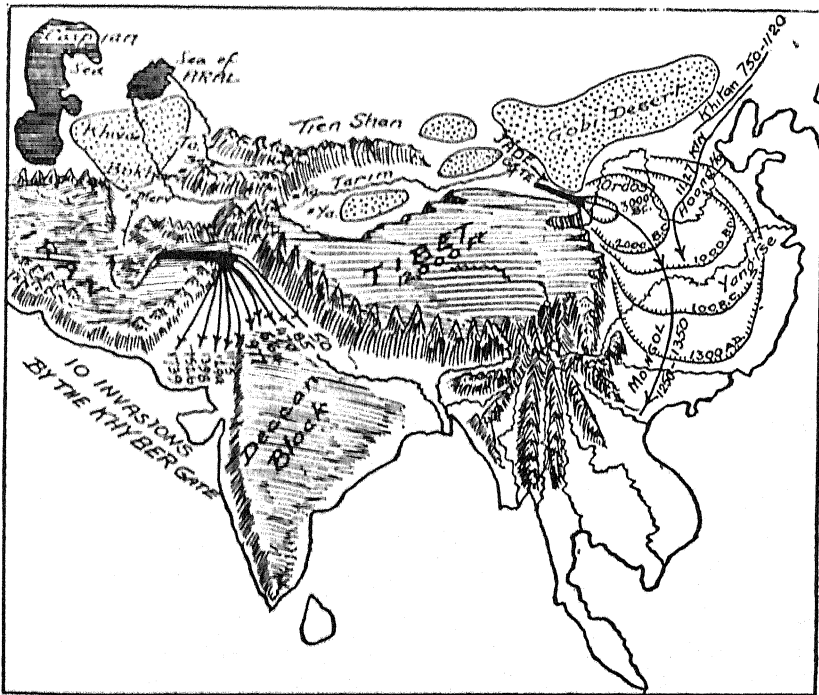


FIGURE 28.—Invasions of India and China, via the Khyber and Jade Gates, showing the conquests of both lands by Alpines from the heart of Asia.

have set in movement the Negro tribes of Africa. Perhaps only in Australia can we say that this centrifugal movement of Alpines has not had much bearing on the pre-Columbian distribution of the Australoids.

It will be sufficient in illustrating this vital process to consider the main features of the history of the Indian and Chinese "sub-continents."

As regards the ingress of tribes into India, there is only one notable corridor, that which enters at the north-west corner by way of the Khyber Pass. India is shut in on the north by the world's highest mountains. There has been very little migration between Tibet and the plains below, though the people of the hills in Nepal and Bhotan are linked to those of the Tibetan plateau rather than to those of the hot plains of India. Only once can I find a record of the near approach of Chinese to India, when Kien Lung's armies reached Nepal (via Tibet) about 1792. On the north-east the same condition obtains. Here the unique topography of the region of the Burma Road has prevented much intercourse through the ages. Here are six gigantic "young mountain" ranges, due to the fanning out of the Tibetan plateau into a series of nearly parallel ridges as shown in Fig. 28. The coastal road to the west leading to the Persian Gulf is one of the hottest and driest in Asia, and has never been much used for traffic.

The approach to the Khyber Pass is, however, by no means easy (Fig. 32). The Murghab and Heri Rud Rivers lead south from the plains of Turkestan at Merv, and bring the traveller into the Persian plateau near the Helmund desert. From here he must turn east into Afghanistan, and travel for several hundred miles amid the high mountains of that country till he reaches the Kabul River. This in turn leads through the narrow rugged Khyber Pass down to the plains of India.

It is supposed that most of the later races of India have reached the sub-continent by this route. Undoubtedly the great invasions of the Aryan-speakers came this way from the cooler lands of Turkestan. Many, perhaps most, of these tribes were of Alpine race, and their migrations before 1400 B.C. were merely the forerunners of hundreds of migrations of similar character. Few of these ever moved back from the rich plains into the barren northlands; and only once or twice did the Indian conquerors extend their empires in this direction. Hence the outstanding feature of Indian history has been the influx of settlers, conquerors, and soldiers of the Alpine races from west central Asia into India.

Space limits admit only of a summary of these Alpine migrations. No doubt most of the Greek armies of Alexander in 327 B.C. were of the broad-head type, and many of the Greek allies remained in the north-west of India. In 181 B.C. the Bactrians, another Alpine tribe, overran north-west India. About A.D. 100 the Saka from central Asia also used this route, and about the same time the Yue-Chi or Kushans

(from Kan-Su in China) began their rule of north India. In A.D. 470 allies of the latter, called the White Huns (or Ephthalites), reached far into India. (They are kin to the interesting Khazars of the Ukraine, who became Jews a few centuries later.) In 664 and 977 were two of the numerous Moslem invasions, all of which used the Khyber Corridor. Around 1175 an Afghan family ruled north India for a time; and in 1294 occurred the third Moslem invasion which conquered the Deccan. Timur, the great Mongol emperor, entering from the north-west sacked Delhi in 1398; and in 1526 his descendant Baber settled in India. Akbar, who lived about the same time as Elizabeth, ruled almost the whole of India. In 1739 Nadir Shah from Persia was the last of the Moslem invaders from the north-west.

It will be noticed from these data that great numbers of northern immigrants must have been continually pouring into India. They slowly displaced the Dravidians as well as the primitive Australoids into the hills of the Deccan, where today many millions can be studied. Since, as stated, there is hardly an instance of a migration in the other direction, we can conclude that the centrifugal movement of the Alpines from central Asia has been the outstanding feature of Indian history.

Much the same migration features characterize the history of China, though here the Chinese were much more civilized than the early Indians. The early history before about 776 B.C. is not well dated. Archaeological studies show that the true Chinese culture reached the fertile lands of the east through the Jade Gate, which is the counterpart of the Khyber Gate. Here the vast plateau of Tibet shuts in China on the west, while on the north are the inhospitable deserts of the Gobi. These did not prevent nomad tribes from attacking China, but did prevent any expansion of the Chinese people in that direction. The six parallel "young mountain" ranges of Burma shut in China on the south-west as already noted.

The gradual spread of the essential Chinese culture is suggested in Fig. 28. By 2000 B.C. this culture was affecting the tribes living on the middle Hoang Ho. By about A.D. 1300 conquest had carried the dominant culture to the south of China. Here the primitive types, akin to the Lolo of today (who are Mediterranean in race), were soon merged in the populous Chinese from the north, and adopted their culture in large part very quickly.

During the nineteen centuries of the Christian era the history of China has differed somewhat in character from that of India. Only

three or four periods of foreign domination occurred, and of these the Khitan only affected the extreme north-east. Around 1127 the Kin tribes from Manchuria conquered China as far as the Hoang Ho, though the Chinese dynasty of Sung ruled south of that river. Jenghiz Khan, the great Mongol conqueror, aided the Sung against the Kin, and by 1232 the power of the latter had vanished. However, the natural result of this alliance was that the Mongols refused to withdraw, and around 1252 Kublai Khan conquered the whole of China for himself. This great dynasty of Mongols only lasted a century; and in 1355 a Chinese peasant led a successful revolt against the Mongols. About 1644 the Manchus (an Alpine race) invaded China from the north-east, and within a generation had conquered the whole country from north to south. This dynasty lasted till the declaration of the Republic in 1911.

Thus except for about 500 years the Chinese have had rulers of their own culture folk; and these often carried the Chinese rule as far as the confines of Tibet and even west of the Tarim to Kashgar (Fig. 28). Perhaps in large measure due to the more open character of China to the north, there was a much greater "Alpinization" of the aborigines than we saw in India. As in the latter country there can be no doubt that the key to the history is the "outward expansion of the Alpines." This great experiment, lasting over 2,000 years, would seem to show that there is some inherent advantage in favour of the brakeph Alpines over the marginal Mediterraneans, Nordics, and more primitive races.

PART II

ENVIRONMENT, CULTURE AND NATION

*"For as Geography without History seemeth a Carcasse without motion;
so History without Geography wandreth as a Vagrant without a certain
Habitation."*—JOHN SMITH of Virginia.

CHAPTER V

THE SIGNIFICANCE OF CERTAIN CULTURAL DISTRIBUTIONS

WE shall do well to obtain a clearer idea as to the meaning of the term Civilization at this point. We have cleared the foundations so to speak in our brief study of the earth environment, and of the primitive classes of mankind. Where does civilization start? Is it a function of race or of culture or of both?

Various definitions of civilization are current: such as "the state of human progress since mankind attained sufficient intelligence and social unity to develop a system of government."¹ Some writers link the beginnings of civilization with the discovery of the art of writing; or with the first growth of food crops; the use of metal; etc. We shall do better to ignore specific criteria, and try to obtain a rapid picture of the general development of civilization.

Some such summary as is suggested by Morgan's studies of the growth of civilization² will help us at this juncture. Briefly he divides human history into three major divisions. The first is Savagery, the second Barbarism, the third Civilization. These are broken down into about a dozen sub-divisions much as in the following table, based on a discussion by H. S. Williams.

Savagery	I	Speech-using primates
	II	Fire-using primates
	III	Bow and arrow users
Barbarism	IV	Pottery users
	V	Domestic animal users
	VI	Iron smelters
Civilization	VII	Users of writing
	VIII	Users of printing
	IX	Users of steam-engines
Present Trends	X	Humanitarians
	XI	Eugenists
	XII	Internationalists

It was soon realized by sociologists that the customs of living primi-

¹See the article on "Civilization" by H. S. Williams in the *Encyclopædia Britannica*, 11th ed., 1911.

²Jacques de Morgan, *Prehistoric Man, a General Outline of Prehistory*, London, 1924.

tive folk, now far from centres of modern progress, to a considerable degree resemble those of our ancestors. As regards the dawn of European civilization this concept is well brought out in the book by the Oxford geologist W. J. Sollas, which is entitled *Ancient Hunters and their Modern Representatives*.³ For instance, he suggests that from the Australian aborigines we can learn much as to the tools and habits of early Paleolithic man in Europe, while the Eskimo preserve many of the methods in use by the later aborigines in Europe. He shows that the ice-age conditions in Europe produced a culture not unlike that of the Eskimo; and indeed there are some ethnologists who detect a real kinship between our forefathers in Europe, and the (biologically) somewhat similar folk of Arctic America.

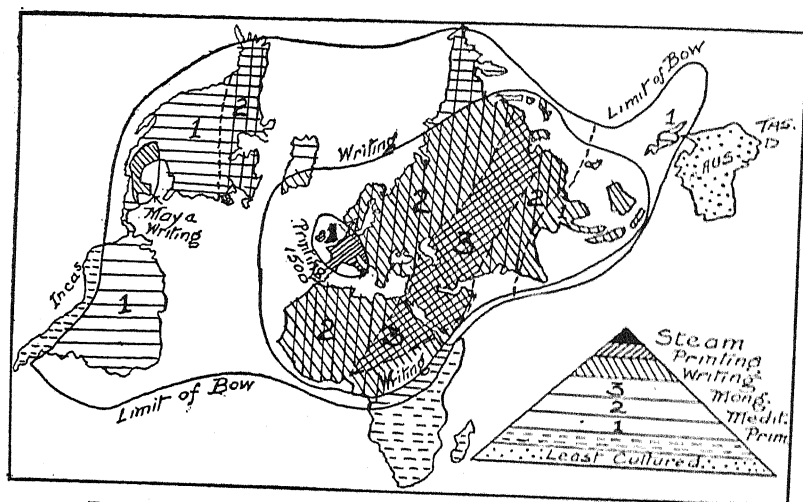


FIGURE 29.—Zones of culture about A.D. 1500 shown in a very generalized way. Printing and writing are the central zones. Methods of archery illustrate the intermediate zones. The least cultured folk are in Australia. (The site of early steam-engines is added.)

Reams have been written on these and allied problems, but only two topics will be considered in this book. As in the preceding discussion of race, they are concerned essentially with the varied environments and the patterns of distribution. Let us take the latter first. In Fig. 29 I have plotted in a somewhat simplified way some of the criteria which appear as landmarks along the road to civilization. The

³Third ed., New York, 1924.

distributions there charted obviously lend themselves to interpretation by our familiar Zones and Strata technique.

No human tribe has been found without the knowledge of speech and the use of fire. Probably the aboriginal Tasmanians were the most backward, as mentioned earlier. We may accept Morgan's use of the bow and arrow as indicating a great step forward in man's conquest of his environment, especially of the stronger animals by whom he was surrounded. This technique has spread all over the world except to Australia, where it never seems to have been known. Its use died out in most of Polynesia, but there no fierce four-footed enemies existed to endanger settlement by man. For other reasons the bow never seems to have attracted the primitive tribes of South Africa, or those in the south-west of South America.

Wissler and others have shown that the latest and best technique of the bow is found in central Asia, where the "Mongolian release" of the arrow was used (Fig. 29). In more marginal lands the "Mediterranean release" was used, while in the periphery of the "lands of the bow" the "Primitive" type of release was used. For reasons which have been explained earlier, we may be quite sure that the cult of the bow developed first in central Asia, and slowly spread over most of the world. The "Primitive" method (1) of releasing the arrow is still in use in the margins, i.e., in most of America, and in India and the East Indies. The latest technique, the "Mongolian" (3), is still found near the centre of evolution of archery, i.e., near the centre of the zones here depicted. (Notice the interesting resemblance to racial zones.)

The distribution of the methods of Writing (in pre-Columbian times) is approximately suggested by the isopleth so labelled in Fig. 29. In the New World only the Mayas had a crude method of pictorial script, not yet deciphred. All the data indicating the earliest peoples to use writing lead us to a region somewhere in the vicinity of Persia. It may well stem from the cradleland of so many other cultural and biological groupings.

It is not till the times of Columbus that any of the criteria of civilization (if we adhere to Morgan's list) originate outside of this most critical area with respect to human progress. However, printing (by movable metal types) seems to have been invented by Costar of Harlem about 1445; and was developed by Gutenberg of Mainz about a decade later. By about 1500 printing-presses had spread over much of western Europe, as suggested in Fig. 29. The steam-engine may be credited to

Watt of Glasgow about 1770. I have represented this region on the map (Fig. 29) by solid black, though, of course, the steam-engine came into use 300 years after the times of Columbus.

It would be easy to point out various objections to the order of the criteria employed in Morgan's classes, as epitomized at the beginning of this chapter. For instance, the folk of the Peruvian plateau in South America seem not to have used bows, but they produced some of the finest pottery in the world; and their Inca civilization just before the Spanish Conquest was in some ways comparable with that of much of contemporary Europe. They never, however, produced a method of writing, though their quipu knots were quite complex, and served as a series of mnemonics.

So also the Australian aborigines had no idea of pottery, though they had domesticated the wild dog of southern Asia. In all probability they carried this dog (or dingo) into the southern continent on their crude rafts. We can deduce this fact, since no other mammals reached Australia. All the rest were halted by the straits of the East Indies, as has been suggested earlier. Here we have a very profound example of the effect of environment. The Australian aborigines, it is supposed, came into Australia about the time of the last ice age,⁴ when man had nowhere progressed far beyond the early stages of Palcolithic culture. They borrowed little from outside culture.

They left behind in Asia millions of their kin, who constitute the so-called Veddahs and Pre-Dravidian people of southern India and elsewhere. These folk came into close contact with many later races, such as the Dravidian-speakers (who probably developed the wonderful Mohenjo-daro civilization of the lower Indus basin), and the Aryan-speakers who brought in a still later type of civilization about 1500 B.C. There being no very marked physical barrier between the "Australoids" of India and these later-culture folk, the primitive aborigines learnt a great deal from the newcomers. For instance, it is probable that the use of iron began quite early in southern India, perhaps as far back as 4000 B.C. if we follow Mitra.⁵ No doubt it was soon employed (and probably smelted) by some of the primitive folk of the south of India, though it seems logical to assume that the discovery was made by some of the Dravidian (akin to Ethiopian) tribes.

⁴Evidence leading to this conclusion is offered in the writer's book, *Environment, Race and Migration*, Toronto, 1945, chapter vii.

⁵*Prehistoric India*, Calcutta, 1927.

901.9
742
In Australia the Australoids (akin to the aborigines of India) had just about arrived at putting a better edge on their Palcolithic stone axes by grinding the chipped edge. We may roughly represent their culture by saying that they were for the most part just advancing towards early Neolithic conditions. The chief purpose of these paragraphs is to emphasize the fact that progress in civilization is essentially a question of contacts and culture, and only indirectly does it depend on race.

Yet we may use these racial types to illustrate a rather important point in human progress. It is about 150 years since white colonists arrived in Sydney. The "First Fleet" entered the Heads in January, 1788, and contact was established with the aborigines right away. In the preceding chapter something has been said as to the general condition of the aborigines. What is the best that they have done? The writer lived for thirty years in Australia, and travelled more widely than most folk over the continent. He only met one fairly well educated aboriginal (though no doubt there were others). Mr. Unaipon was a very pleasant-spoken man of middle age who was obsessed with the idea that he had discovered a "perpetual motion machine." No arguments of mine would deflect him from this unprofitable line of work, though I pointed out to him his special opportunities for unrivalled research in the anthropology of the Australoids.

One example of this kind proves little or nothing, but one must admit that the social environment is of very great importance in stimulating human progress. Since, as is natural, the white settler has little belief in the intellectual possibilities of the aboriginal, the latter inevitably is much swayed by the opinion of his superiors. We can only wait for further developments before we judge the aboriginal. It is perhaps of some interest that two Australian novels have recently appeared in which the highly educated and attractive hero (and heroine in the second case) is described as a full-blooded Australoid. My own opinion is not very hopeful, since I think that the Australoids will have merged into the dominant races before their chance to make good socially (as a distinct biological group) arrives.

258.
The chief importance of the isopleths in Fig. 29 is that they almost definitely prove that civilization began in the south central part of Asia. This is suggested by the zoning of the distribution of the types of bow. The same thing will in time be worked out for the various

by Taylor, Griggitt.

types of writing that have survived. No doubt the very restricted Maya writing was quite distinct from anything produced in the Old World. But it in turn developed from picto-graphs, which one may suppose were known to the Neolithic tribes who migrated into the New World some fifteen or twenty thousand years ago. However, it may have developed quite independently of the Old World cradle.

As far as the Old World is concerned, there seem to have been three or four dominant types of script in use in early historic times. The types with which we are familiar originated somewhere near Palestine and Egypt. Probably they in turn link with the various scripts of Mesopotamia. The Chinese types of writing seem to have developed, like the rest of their specialized culture, in the north-west of their country; and some authorities see a slight connection with the scripts of Mesopotamia. The many scripts of the south-east of Asia, as far as Java, etc., are to a considerable degree based on Indian scripts. Many of these are derived from the Sanskrit, but others possibly derive from the remarkable writing used in Mohenjo-daro perhaps as far back as 3000 B.C. At any rate as the result of this very brief and necessarily incomplete summary, we can provisionally accept the conclusion that the art of writing—so fundamental a signpost on the road to civilization—was first developed near the cradleland in southern Asia.

If we return to Fig. 29 for a few moments it will be noticed that I have added (as a kind of legend) the "strata" of civilization which we have been considering. As in other illustrations of the Zones and Strata technique this graphic method is of some interest. It suggests, though in a very incomplete form, that a study of zones, coupled with a study of the historical data (as indicated in the strata), gives us a fair idea of the progress of civilization, as far as the period of Columbus. Thus the least cultured of all (low down in Morgan's class II) is the Tasmanian; who is found, as we should expect, in the lands most inaccessible from Asia. These few thousands of primitive people—probably half-caste between the Negrito and the Australoid—when first met with around 1800, were hardly in the Paleolithic stage. They made no flaked stone axes (though they had a very crude boucher) but merely used crude chipped spokeshaves to scrape their wooden spears. The latter were not supplied with stone points, but only hardened in the fire. They could build a sort of balsa (raft), by which they had crossed the Bass Straits. They built crude huts, and used

skins for clothing. No adequate record has been kept of their language, though some vocabularies are known. The following is stated to be a Tasmanian invocation to the sun.

Pugga-noobra nah; Palla-noobra nah;
Worka-lenna nabba-gcena; Piterina loyna.

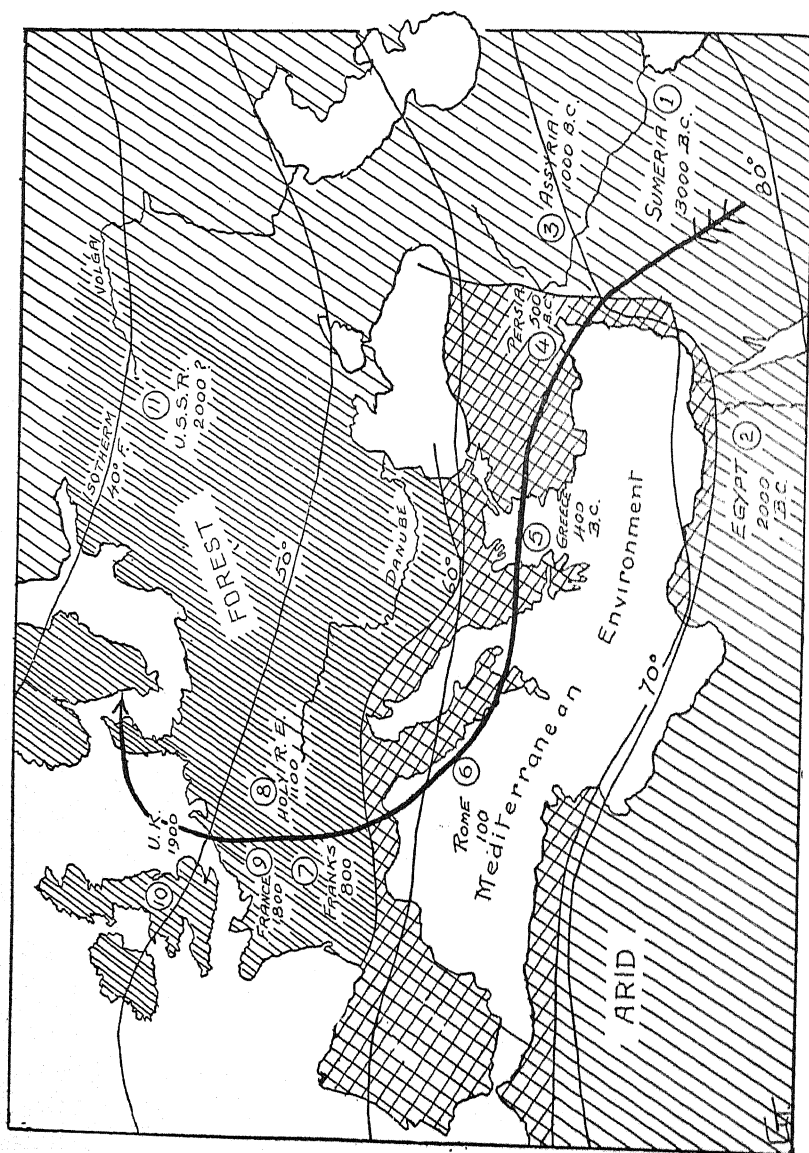
Our second stage in the evolution of civilization can be based on the sociology of the Australian aborigines as they were around 1800. Their techniques have been described sufficiently on a previous page. Only in the domestication of the dog had they advanced beyond stage II of Morgan's classes.

I do not know the grounds which led Morgan to base his class III on the discovery of the bow. As suggested, I should have placed pottery before that, and also the domestication of animals. In South Africa, for instance, we find no bows, yet pottery is well developed; so is the use of cattle, etc., while the natives are expert in the elementary smelting of iron. Perhaps it is better not to lay too much stress on this order. At any rate it is clear that the Old World now moved ahead of the New in regard to the criteria of modern civilization. If we omit the Maya region, we find that the Old World countries—apart from those marginal lands already discussed—were all civilized to some degree by the time of Columbus; in other words they had arrived at stage VII in Morgan's categories.

There is, however, a very interesting phase in the development of civilization—or at any rate of European civilization—which occurred in the transition from stage VII to stage VIII. It depends to a considerable degree on the varied environments found in the European continent, and has engaged the attention of the writer for many years. Moreover, this transition was contemporaneous with the rise to power of the "National Idea" in Europe. As usual the concept to which I wish to draw attention can best be demonstrated by diagrams, one of which I reproduce from a paper published some years ago, the other being new.

Over twenty years ago I published a table and a map (in colours)^a which concerned the "Poleward Movement of Civilization." There I point out that the earliest town civilizations of which we have any knowledge occur to the south-east of Europe in Mesopotamia, where

^a"The Evolution and Distribution of Race, Culture and Language" (*Geographical Review*, New York, Jan., 1921).



the present average temperature is around 78° F. At present, at the end of a period of about 6,000 years, the most complex type of civilization (in the Old World) is found in the north-west of Europe, with an average temperature of about 50° F. It is this movement of civilization from the south-west of Asia to the north-west of Europe which seems to me the outstanding geographical feature of the growth of our type of culture. The reasons for this movement are in no small degree determined by the varied environments. Of great importance, and, of course, to some extent depending on the environments, is the part played by technological advance in a number of directions.

The map represented in Fig. 30 shows the Near East and Europe crossed by average annual temperature lines. The dates of the various main empires and the general temperatures and rainfalls which controlled them are given in the following table.

CHANGES IN EMPIRE AND ENVIRONMENT

Approximate Date	Culture Group	Average Temperature	Average Rainfall
B.C. 3000	Sumerian	75° F.	10 inches (Irrig.)
B.C. 2200	Akkadian	74°	10 " (Irrig.)
B.C. 1500	Egyptian	72°	2 " (Irrig.)
B.C. 500	Persian	65°	15 "
B.C. 330	Grecian	63°	20 "
A.D. 100	Roman	60°	20 "
A.D. 500	East Roman	60°	20 "
A.D. 1000	Holy Roman	55°	30 "
A.D. 1500	Spanish-Austrian	56°	30 "
A.D. 1700	French	52°	35 "
A.D. 1900	British	50°	40 "
A.D. 2000	U.S.S.R.?	45°	20 "

At first glance a seeker for causes would be excused if he stated that the data supported the view that, as civilization progressed, lower and lower temperatures were found to be the most advantageous. If a time-temperature scale be plotted, the resulting graph, as shown in Fig. 31, certainly suggests some such conclusion. Indeed I am of the opinion that it is a factor in the evolution of civilization. Huntington's research shows that there are different optimum temperatures for the best physical and the best mental work. For the former he thinks that temperatures around 60° F. or 65° F. are the most satisfactory, while for the best mental work the temperatures are much lower, say between

OUR EVOLVING CIVILIZATION

40° F. and 45° F. Could we not at first glance say that the graph in Fig. 31 is but another illustration of the universal rule that, as man progresses, "brawn" gives place to "brain." In the early days of human civilization in the Near East, physical prowess was much more important than it is today, when an acute brain is relatively as well as actually of much greater value than large biceps.

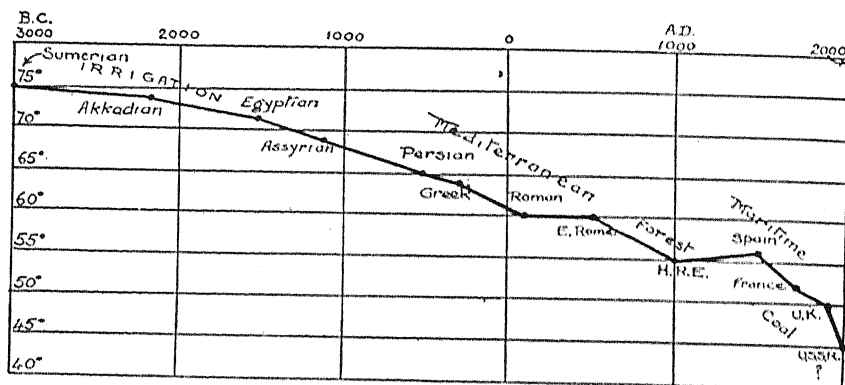


FIGURE 31.—A graph showing that the dominant nations of Europe gradually controlled cooler and cooler lands. But other geographical factors (besides temperature) are also considered.

However, such a simple conclusion is unconvincing, since it ignores so many other factors in the picture. If we consider the other important element in the climate—the rainfall—then we see that there has been an equally striking change in the conditions of the major civilization of the periods. At first the civilizations developed where not only considerable heat, but also considerable aridity was characteristic. Indeed both lower Mesopotamia and Egypt were either desert or near-desert environments. It has often been suggested that sites near a large river under desert conditions were peculiarly satisfactory for the birth of a real town-community. Here a social organization was necessary to carry out the common task of preparing and maintaining the necessary irrigation channels. For a parallel the reader is referred to the fish weirs of the Darling River (p. 92), where the dawn of civilization among the Australian aborigines seems to have been suggested in a similar fashion.

Probably of outstanding importance both in Mesopotamia and in Egypt was the absence of forest growth, since any kind of forest pre-

vented the extension of town settlements in man's early days, much as the exuberant jungles of the tropics still defy the best efforts of the civilization of today. Perhaps only in the sugar-cane fields of northern Queensland is the laborious work of a tropical plantation near the Equator entirely carried on by Europeans. Elsewhere the hard work is done by so-called inferior labour, though the supervision is carried out by folk of European culture. (In a later paragraph the rival claims of Egypt and of Mesopotamia to be considered the cradleland of civilization will be discussed.)

In the Near East there were, therefore, in the early days all the conditions suitable for the growth of a complex civilization. There were no forests to spring up each year, and choke the crops; there were inexhaustible depths of fertile soil brought down by the twin Mesopotamian rivers or by the Nile, an adequate and regular supply of water, and a plentiful supply of heat, since both localities are on or near latitude 30° N. Under such conditions flourished the empires of Sumeria, Akkadia, Egypt, and Assyria.

ENVIRONMENTAL CHANGES IN THE ASIATIC CRADLELAND

It is a paradox of man's progress that the scientific investigation of civilization should be carried out by the latest heirs of civilization. While there is some doubt as to whether civilization began in Egypt, Mesopotamia, or Turkestan, there is none about the state of north-western Europe or North America some four thousand years ago. Both were occupied by tribes whose main interests have been described as getting, begetting, and forgetting! Not until about the time of Charlemagne on the one hand, or Columbus on the other, was much time devoted to preserving a record in either of these regions.⁷ Yet today they maintain a strong lead in historical investigations.

It is, of course, natural that in the Old World the nearer borderland areas have received most attention. Thus Egypt is better known than Mesopotamia, and the latter better known than Turkestan. There is a widespread belief that civilization began in Egypt, because it has been more carefully investigated as regards ancient historic times. However, many archaeologists think it likely that the typical Egyptian civilization derived from Mesopotamia, perhaps when the "Falcon People" reached Egypt about 3500 B.C. So also the writer has long predicted—from

⁷See *Environment and Nation*, Toronto, 1936.

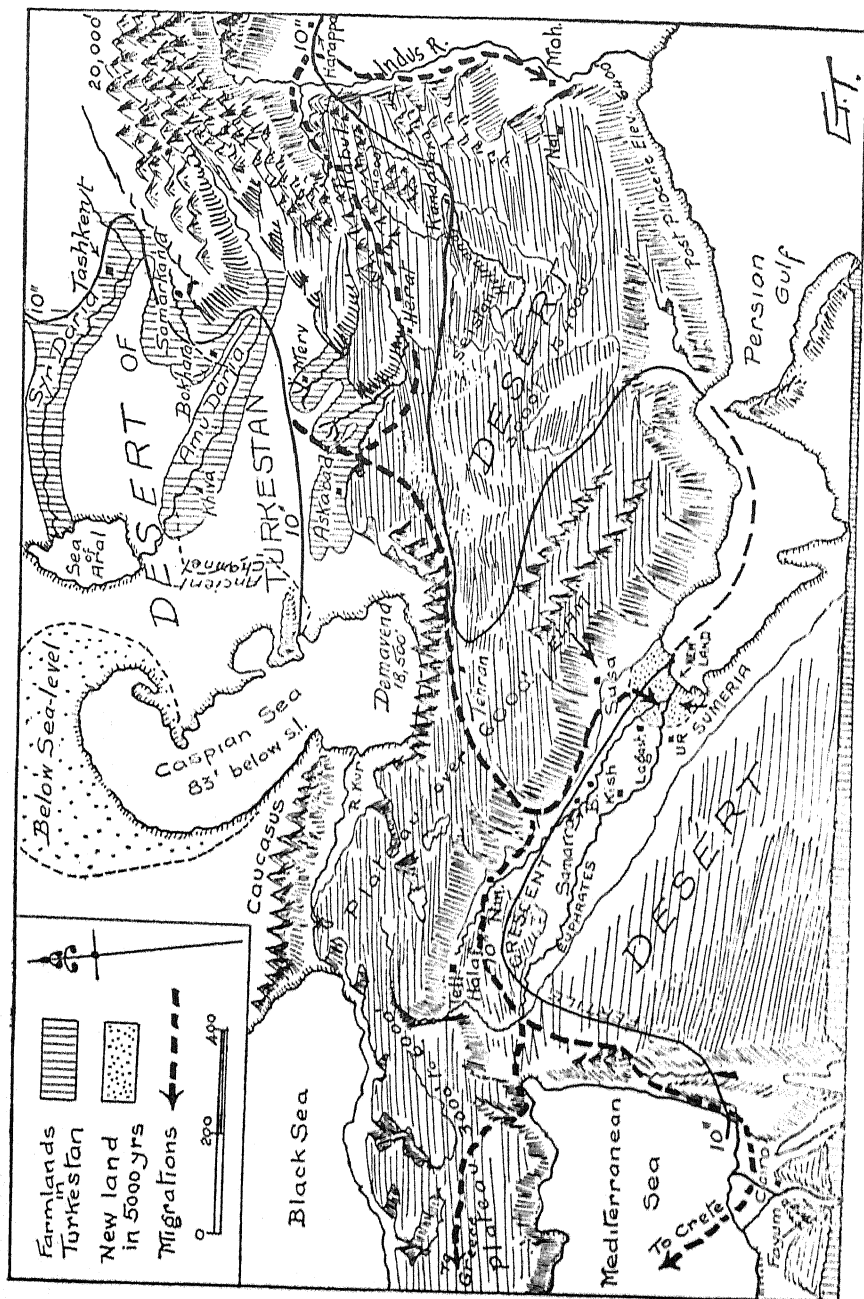


FIGURE 52.—A block diagram of the "Near East" showing the probable cradleland of man, and (later) of his civilization. The heavy broken lines show the corridors of migration for man and his cultures.

his studies of racial migrations and their isopleths—that the Mesopotamian cities will be found in turn to have derived most of their early culture from still earlier cities in the vicinity of Askabad in Turkestan.⁸

We shall do well to examine with some care the environments in the region near the "Six Seas" (Fig. 32). This is but another name for an enlarged "Near East," and includes south-west Asia in the vicinity of the Caspian, Aral, Black, Mediterranean, and Red Seas and the Persian Gulf. It is a region of considerable complexity, and one where the climates of today vary greatly within short distances. Even more important is the fact that we have much evidence showing that 6,000 years ago both the topography and the climate differed very materially from what occur there today. It is the great deterioration in the living conditions in these last millenia, which has led many archaeologists and historians to doubt that the cradleland of man was situated in what is today a very poor environment.

The somewhat simplified block diagram represented in Fig. 32 shows most of the salient features of today fairly clearly. A great plateau, much like a gigantic railway embankment (including Anatolia and Iran), separates the three northern from the three southern seas in this area. This plateau was elevated during the last period of mountain-building and is therefore a product of the so-called "Alpine Storm," which raised the Alps and the Himalayas. These striking topographic changes, however, took place long before the time of civilized man; probably over a million years ago. However it is certain that the country looked very different about 5000 B.C. from what it does now. Few parts of the world have changed more during the human period. It is believed that the Mekran coast in Persia has risen 6,400 feet since Pliocene times.⁹

In the very early days of primitive man, when he was changing from a Paleolithic to a Neolithic way of life, and beginning to plant grains, make pots, and domesticate animals, it is likely that a vast sea extended across the lowlands between the Black Sea and the Sea of Aral (Fig. 18a). The Aral Sea indeed was in a sense the eastern extremity of an enlarged Mediterranean Sea. No doubt the rains were much heavier on the shores of this large sea than they are in most of Turkestan today. Gradually this sheet of water broke into the three separate seas as shown on the map of today.

⁸"The Evolution and Distribution of Race, Culture and Language," *loc. cit.*
⁹J. V. Harrison, "Jaz Murian Depression" (*Geographical Journal*, May, 1943).

The rainfall fell off undoubtedly, as the old elevated shorelines of the Caspian show. Indeed, right into the Middle Ages, the River Amu Daria contained enough water to reach the Caspian along the ancient channel shown in Fig. 32. Now, however, all Turkestan to the north of the heavy line (marked "10 inches") is a desert; though along the course of the short rivers there are many acres of irrigated farmlands, which are clearly shown on the map.

So also on the southern side of the great plateau of Iran, there have been many changes in the last few millenia. For the early days of Mesopotamian civilization we have clay records which show that Lagash and Ur were flourishing ports. They are now over 100 miles from the waters of the Persian Gulf; and the "New Land" (Fig. 32) represents the silt brought down from the Iranian plateau by the waters of the Tigris and the Euphrates. There is little doubt that the Gulf once extended to the north-west, perhaps almost to Nineveh. It represents a downfold of the crust, which developed at the same time as the upfold of the plateau immediately to the north-east. Being below sea level, this depression was, of course, immediately filled by the ocean. The ensuing infilling of the downfold is exactly similar to what is taking place in the similar downfold of the Adriatic Sea, which may have developed about the same time.

It is hardly necessary nowadays to bring forward evidence proving that notable climatic changes have occurred in the last few millenia. We may be sure that science will decipher the record in the Near East as accurately as it has been done in north-west Europe and in the United States. A generation or so ago it was customary to explain the deterioration of Near East lands in terms of the destruction wrought by barbarian invaders. Cutting down trees and the destruction of seedlings undoubtedly led to soil erosion, but it is doubtful if they have altered the annual rainfall to any notable extent. Huntington has long demonstrated the deterioration in climate in this area. It seems impossible to explain many of the campaigns of Alexander around 330 B.C., unless we believe that the food and fodder supplies of Iran and Iraq were much superior then to what we see today. In a recent paper Huntington has recorded the distribution of ruins and of villages in Palestine. He finds that in early historic times south and east of the Dead Sea there were many districts with thirty or forty little settlements where there are three or less today. The ruined villages depended on local rainfall—and there is clearly not a large enough rain supply today.

It is perhaps worth noting that in addition to the records of past rainfall preserved in the growth-rings of trees—which are of value only in forest areas—there are also the records of pollen grains which can be investigated in all swampy areas; and furthermore in semi-desert lands it is easy to deduce, from the character of the stream deposits on the slopes bordering the desert, how the rainfall has varied in the past. Hence the historian may be assured that sooner or later we shall know the essential features of the change in climate which has so drastically affected the Near East. (See also Fig. 10.)

Turning now to the climatic data given on Fig. 32 it is seen that there are three main deserts. Turkestan is a lowland crossed by the semi-permanent rivers the Syr Daria and the Amu Daria. There are also many smaller rivers flowing down the slopes of the great mountains to the east, which have given rise to large settlements such as those of Merv, Samarkand, and Bokhara. It is the writer's firm conviction that at the dawn of civilization there was a rainfall of about 15 inches instead of the 10 inches shown now in this part of the world. This drop of 5 inches would mean very little in a region such as that of the eastern United States where the rainfall is around 40 inches. But it had a marvellous effect in the semi-desert areas which we are now considering.

Of the three regions under consideration (Fig. 32), we may say that each had some advantages in those far-distant periods. Given an adequate water supply over large areas, it may be that Turkestan was the best of the three. The climate was much more stimulating than that of Egypt or Mesopotamia as may be seen from the "range" in the following table.

	January	July	Range	Annual Rain	Season of Rain
Tashkent (Turkestan)	30° F.	81° F.	51° F.	15 inches	Spring
Baghdad (Iraq)	49°	92°	43°	9 "	Winter
Cairo (Egypt)	54°	84°	30°	1 inch	Winter

The rainfall in Turkestan was adequate for most primitive crops, if we assume an increase of 5 inches a year over present supplies. In addition the innumerable streams flowing down to the Turkestan depression (around the Sea of Aral) would give as good facilities for irrigation as do the twin rivers of Iraq, or the Nile. The latter river at

Cairo is lowest in June, and the new flood water comes in July, rising to a maximum in October, when the level is 16 feet above that of June. Silt is being added north of Assouan at a rate of about $4\frac{1}{2}$ inches a century.

THE GROWTH OF CIVILIZATION IN THE NEAR EAST

The record of man's progress through the ages is admittedly most complete in the lower valley of the Nile. The present writer has described¹⁰ the changing environments and cultures which have been investigated in this region. Paleolithic flints are found associated with the upper river-terraces of the Nile near Thebes. So also the ancient beaches of the lake in the Fayum Oasis (Fig. 86) show a series of cultures of Paleolithic and Neolithic age.

Childe¹¹ gives us valuable comparisons between the cultures of Egypt and the Asiatic regions with which we are at present concerned. He describes the early farming communities near Badari, Tasa, and Merimde (all within 150 miles of Cairo). They seem to have been contemporaneous with the beginnings of desert conditions along the lower Nile. They antedate the predynastic period of Egypt, in which according to Childe we begin to find objects, devices, and motives "that were native and lasting in Mesopotamia, but in Egypt occur only sporadically or enjoy a quite temporary vogue." The writer set forth the view, more than twenty years ago, that the prehistoric Egyptian civilization would turn out to be developed in a sort of outlying settlement depending on cultures derived from Mesopotamia. This view seems to be corroborated by the latest investigations in Mesopotamia to which the writer has access.

In 1905 Pumpelly published the results of his investigations at Askabad in Turkestan; and described the following archaeological strata.

Top:	14 feet	with	Iron Age	relics.
	15 "	"	Copper and lead	relics.
	70 "	"	Pottery, made on a	wheel.
Bottom:	45 "	"	Hand-made	pottery.

It is impossible to give the number of years indicated by these immense thicknesses of debris. No doubt they represent the fallen mud walls of early houses in many cases. But the pottery at the bottom of his

¹⁰Environment, Race and Migration, 1945

¹¹V. Gordon Childe, *New Light on the Most Ancient East*, London, 1934.

shafts is buried far deeper than in most of the "digs" in other parts of the Near East. Hence we can provisionally assume that pottery was in use at an extremely early date on the northern slopes of Iran (Fig. 32).

At Susa on the south-west slopes of Iran (Fig. 32) it has been claimed that 26 feet of debris represent the time interval since 4500 B.C. Yet below this is another 50 feet of debris, which would take us back to the time of 12,000 B.C. for the bottom layer, if we adopt the above-mentioned ratio. At this bottom layer, pots with crude cuneiform designs were discovered. However, not many archaeologists would accept a date as old as 12,000 B.C. for such a culture.

In the following table I have tried to correlate some of the important culture-levels in this part of the world, using the dates which seem to agree best with current ideas.

EARLY CIVILIZATIONS IN THE NEAR EAST

(Dates only approximate)

Date	Lower Egypt	Sumeria	Assyria	Indus and Turkestan
B.C. 2000	Hyksos			Early "Aryans"?
2500				
3000	Khufu and Pyramids		Nineveh temple	
3500		(Susa II) 4. "Metal kings"		Mohenjo-daro
4000	Falcon Folk from Elam?	Tell Uquair temple 3. Jemdet Nasr 2. Uruk		
5000		1. al Ubaid (Susa I)		Hissar I (Tehran)
7000			Earliest Tell Halaf Earliest Samarra	Askabad?

The best-known civilization of Mesopotamia developed on the "New Land" built up of the silt brought down by the two great rivers (Fig. 32). It is clear that the environment must have been very marshy in the early days of settlement. Moreover, in early Neolithic times this area had not yet been sufficiently silted to form more or less dry land. Hence we cannot expect a complete sequence of cultures in these new lands—which the ancients called "Sumeria." The classic early Sumerian

culture comes from the vicinity of Ur (Fig. 33); and is known as the "al Ubaid" culture. These early farmers used chert hoes, slings, stone maces, and fine painted pottery (Fig. 33). The latter was used as far as Samarra and Susa; but it is always hard to tell where a given type of pottery originated, i.e., whether at Samarra or at al Ubaid.

A few miles to the north of Ur is the site of Erech, and its type of culture is named "Uruk." It is later than that of "al Ubaid." Pale monochrome pots, stone seals for stamping clay, and copper seem to mark this culture. The Uruk folk also built temple mounds on a fairly

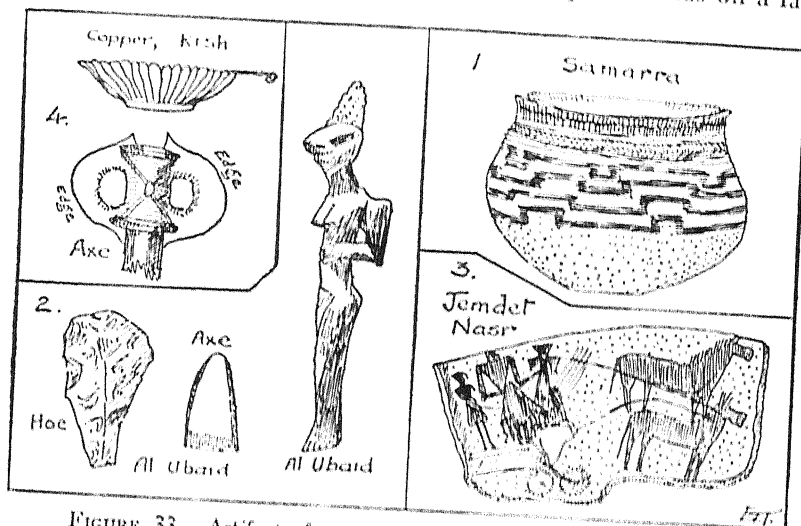


FIGURE 33.—Artifacts from Mesopotamia. (1) Pottery from Samarra in Assyria; (2) Chert hoe, stone axe, and figurine from al Ubaid (Sumeria); (3) Chariot scene on sherd from Jemdet Nasr; (4) Objects used by early "Metal kings" of Sumeria. (Sketched from V. G. Childe's *New Light on the Most Ancient East*.)

large scale. The third culture-layer is named "Jemdet Nasr," and has been investigated in the same region. Perhaps tablets from this culture contain the first attempts at phonetic script. The horse was now in use (Fig. 33), and wheel-made pottery is common. Childe thinks that folk of Semitic speech were in part responsible for this culture.

In 1928 the "Royal Tombs" of Ur were discovered, which contained material evidence of a culture at a higher level than that found in the same period in Egypt. Metal tools and ornaments were used profusely. The warriors fought in chariots and were armed with pikes and

daggers. The metal-workers could braze and solder; and the richer folk used metal vessels rather than pottery. This culture is labelled "Metal kings" in the preceding table. Perhaps belonging to this period is the temple (dated 3500 B.C.) recently excavated at Tell Uquair (near Samarra), in which the coloured frescoes of animals and buildings show a civilization as old as that of Menes in Egypt, and at a higher artistic level.

However, to the present writer, the discoveries made in eastern and northern Mesopotamia are the most interesting of all. At Susa a culture (Susa I) has been described, which has some features resembling those of al Ubaid; and Frankfort is of the opinion that Susa is the parent culture. A later culture at this site is called Susa II, but its relation to the cultures further west is not clear. The date of the latter is about 2700 B.C. according to Childe.

Near Nineveh a temple was investigated by Mallowan, which is dated 2450 B.C. A pit was dug seventy feet below the floor of this temple, and the lowest layer was still rich in human artifacts. Hand-made pottery with simple punctured patterns was the chief find. It would seem to be distinctly older than the painted pottery of al Ubaid. Near here (at Arpachiya) another series of pots was found, considerably below those of the al Ubaid type. These pots closely resemble those from Tell Halaf in the far north of Assyria (Fig. 33). At the latter site fine bowls were dug up, of which one is painted with a crude chariot design. It illustrates perhaps the earliest use of the wheel. However, the lowest Samarra culture is even older than the Tell Halaf culture. Childe sums up as follows: "Tell Halaf is distinctive of a cultural province of the fourth millenium or earlier, that must have made vital contributions to the fabric of civilisations in the Near East."

The position of the remarkable Indian civilization at Harappa and Mohenjo-daro is given in the table. It flourished about 3000 B.C., and the ruins cover at least a square mile at Mohenjo-daro. The people comprised both Australoid aborigines and Mediterranean overlords. It was an irrigation settlement, but the tools were more primitive than those of Sumeria. It is of much interest that alloys of copper and arsenic just like those found at Askabad were in use. The most striking artifacts were the innumerable seals, often marked by signs which have been claimed to be an early form of writing. However, this culture had little bearing on our civilization, so that we need not consider it in any further detail (Fig. 32).

OUR EVOLVING CIVILIZATION

Thus the preceding pages will suggest that the cradleland of European civilization is to be found rather in the vicinity of Iran (Persia) than in Egypt, as was assumed by many early writers. It seems likely that the future may well demonstrate that civilization began in the vicinity of Askabad, moved slowly south-west to Samarra on the Tigris, passed down the twin rivers to Mesopotamia, and thence spread westward to Egypt and to Europe (Fig. 32).

CIVILIZATION AND THE MEDITERRANEAN ENVIRONMENT

The second phase of the development of our civilization was surely linked with the exploitation of the Mediterranean Sea. In no other part of the world is there an environment quite of this character. This is not the place to go into the matter in great detail, but it is easy to show that the "Mediterranean climate"—though present to some extent in each continent (Fig. 5) where lands are available in latitude 35° —nowhere else is accompanied by so many other factors advantageous to early civilized man. Koeppen, the great authority on climatic classification, labelled this type of climate "Cs." This notation means that the

REGIONS WITH A MEDITERRANEAN CLIMATE

Continent	Region	Environment	Approximate Area	Notes
Europe and north Africa	Shores of Mediterranean Sea	Hilly coasts of central Sea, extending over 2,000 miles to east	400,000 square miles	Cradle of our civilization
Asia	Anatolia, Palestine, Mesopotamia	East of Mediterranean Sea	200,000	ditto
South Africa	Capetown	Tiny area of little importance	2,000	Too marginal to produce any high culture
Australia	South coasts from Perth to Melbourne	No inland sea	125,000	ditto
North America	Southern California	Small area of little importance in early America	100,000	ditto
South America	central Chile	ditto	40,000	ditto

temperatures are warm but moderate, admitting of plant growth in every month of the year, and the rainfall occurs almost wholly in the winter. We may compare the few regions endowed with this type of climate in the table given above.

The combined areas of what we may call the "original" Mediterranean environment amount to 600,000 square miles. Near these rocky headlands jutting into the relatively calm waters of the inland sea grew up innumerable little towns. There was every inducement for the development of a widespread commerce by sea, which in turn led to the union of kindred tribes, which ultimately produced the Cretan and Mykenean civilizations from 3000 to 1000 B.C. All the other "Mediterranean" environments specified in the above table were either much too small, or else situated right at the actual margins of the "tri-peninsular world" (Fig. 5). This distance from the cradleland of culture meant that such places as California, Chile, and southern Australia had to wait till the phase of post-Columbian migration carried the torch of culture right across the sea to these suitable hearths. Already the accomplishments of California and of southern Australia in advancing culture in the last century are becoming well known. Can we not ascribe the "Hollywood Cult" and the advanced labour laws of Australia in some small degree to their sun-drenched Mediterranean environments?

The movement from the arid conditions in the early empires to the cooler, but still rather dry, conditions of the Mediterranean climate is clearly marked in Fig. 30 by the cross-shading. The Persian civilization was a transition, which only lasted a short time, and was followed by the Greek trading empire which controlled the Mediterranean Sea as well as much of the Black Sea. Alexander, of course, carried this empire far to the east, even to the Punjab and into Bactria.

Although the matter has often been discussed, one cannot omit all mention of the "Golden Age of Greece," since it gave a specific slant to the European civilization which followed. This "Golden Age" lasted from about 500 B.C. to 350 B.C. It was due to the mingling of many stimuli, of which the environmental may be stressed here. There seems little doubt that the climate was capable of producing more corn and wine in those days than it can now. We have evidence, from the lines of beaches high up on the shores of the Caspian Sea, that that enclosed sheet of water was some 150 feet deeper in those centuries than it is now. This would indicate that the general rainfall was much greater, since the sea has no outlet and is thus a gigantic rain-gauge.

Of even greater importance was the presence of a widespread layer of soil on the slopes of the hills. Today the outstanding feature of Greece (as the writer saw it in summer) is the presence of innumerable glaring hills and mountains of grey limestone. Hardly any forests are visible, and the agriculture is mainly confined to the small alluviated plains near the coast. The destruction of the forests and the ubiquitous goats and sheep, inevitably prevented the growth of seedlings or good pasture, which in turn resulted in the rapid washing away of the soil from the slopes into the sea.

In the last few centuries it has been clear that Greece has approached overpopulation; and hence has become poor and unable to give much time to culture. In the Middle Ages Greek ships gained considerable profits for the middle class; but of recent years this sea trade has been to a considerable extent taken over by the richer maritime nations. Of course there were many very important social factors in those distant days, and one may mention the influence of fashion! In the "Golden Age" one may believe that the orator and statesman was personally known to all within his city. Public duty in some sort filled the mind of the common man; much as later in Roman times we find "Bread and Circuses" all important; or today in some populous communities "Sport and Gambling"! As I have written elsewhere: "Probably the chief factor was the irresistible outburst of national pride, when Greece [in 500 B.C.] drove back the hitherto invulnerable Persians. We see something of the same kind in England after the Armada was defeated; and Russia in these next few decades may be expected for the same reason to flower as never before."¹²

Rome was of very little significance in the great days of Alexander, for she controlled merely the district around Capitol Hill. The great empire which developed in the next few centuries was based on the mixing of various cultures and races. The humble Latin peasants of the Roman plain were probably Mediterranean in race, while the Sabines and Samnites of the hills may have been brakeph Alpines. So also the Latins spoke of an Aryan language of the "Q" type (to which we shall refer later), while the hill dialects of Umbria were possibly somewhat closer to the "P" type of Aryan. To the north was the foreign Etruscan culture, usually accepted as somewhat akin to that of Mykenac. To the south were the flourishing colonies of the Greeks,

¹²*Environment and Nation*, 1936, p. 148.

and to the south-west were the large islands held by the Carthaginians. These latter were Mediterranean in race and spoke a Semitic language. All these culture strands, except perhaps the last, were woven into the early Latin culture.

By 218 B.C. the Romans were in control of the Italian peninsula, after they had defeated the Gauls of the Lombard plain (Fig. 34). These were almost certainly folk of Alpine race, but probably they spoke "Q" Aryan for the most part. 146 B.C. saw Carthage crushed, and Rome in control of most of southern Greece. About the time of Christ the legions had conquered almost all that territory shown by the cross-

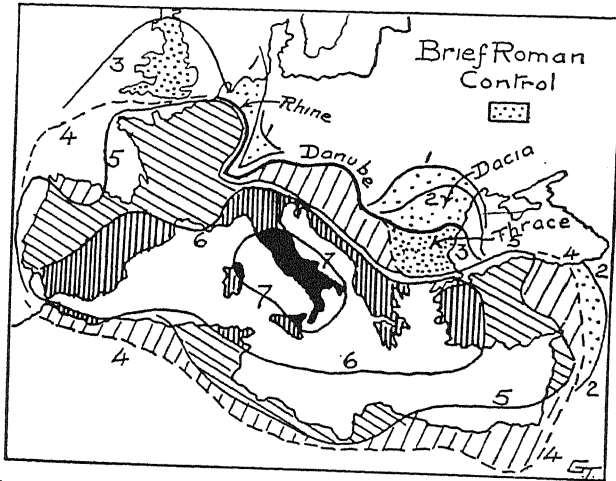


FIGURE 34.—The strength of Roman culture in various lands, indicated by centuries of Pax Romana before A.D. 476.

ruling on Fig. 30. In other words the Roman Empire now reached to the borders of the typical "Mediterranean" environment. Beyond this the conditions changed considerably, becoming dense forest in the west, and open grasslands (steppe) in Pannonia and Dacia (Hungary and Roumania). France was in some sort a transition environment; and the Rhine bounded the dense oak and beech forests of the German plains. One of the vital battles of European history was fought in the dense woods of the Teutoburger Wald (near Osnabruck) in A.D. 9. Here the three legions of Varus were cut to pieces by Arminius and his German allies; and Rome made no determined efforts to extend beyond the Rhine thereafter.

The Roman Empire was based on a system of marvellous roads, which linked northern England with Dover, and thence with imperial roads extending safely to Jerusalem and further. Anyone who wishes to gain an idea of the state of European civilization at the height of the Roman Empire should read the journal of the "Bordeaux Pilgrim,"¹³ where he describes his itinerary from the west of France into Palestine. Such a journey could not have been repeated in such comfort for a thousand years. The writer has seen the inscription carved by Trajan in the Kazan Gorge on the Danube below Belgrade. This commemorates the building of a road through the gorge in the year A.D. 103. The road was destroyed in the course of a couple of centuries, and not until 1836 was a road again made through this vital corridor in eastern Europe.

Although western Rome crashed under the attacks of the barbarian invaders during the fifth century (Fig. 34), yet the Roman culture was kept alive in the south-east of Europe for over a thousand years by the East Roman Empire. This was centred at Constantinople, and was rather more Greek than Roman, since the Greek tongue was that generally used. However, from our present point of view, where we are attempting to summarize the relations of environment to the shift of power and empire, we may say that the new civilization which developed after the folk-wanderings and the Dark Ages, was associated with the Forest environment of northern Europe (Fig. 31). Charlemagne created a strong realm around A.D. 800 which extended to the middle Danube. It grew into the Holy Roman Empire, which also survived in some sort for a thousand years, though it flourished as a separate entity chiefly in the period from 1000 to 1200. Like the Persian Empire, we may describe the early Holy Roman Empire as a sort of transition stage.

When the period of the great voyages commenced about 1450 a new factor comes into the picture, i.e., control of the trade of the Atlantic Ocean. Here the Portuguese took the lead, to be displaced in turn by the Spanish, French, and English. Three of these peoples for a time were paramount in most of Europe, as is suggested in Fig. 31. Then around 1800 the Industrial Revolution began, giving the lead to England by virtue of her admirably placed coal deposits. Of almost equal importance was the defence offered by the English Channel,

¹³C. R. Beazley, *The Dawn of Modern Geography*, 3 vols., London, 1897-1906.

which to a considerable extent kept England free from the embroilments and invasions of the nations of the continent.

However, the gradual evolution of the European type of civilization during the Middle Ages is linked with the growth of the *National* concept. This is the main topic of the next chapter, so no further reference to the development of these nations will be made in this section. In conclusion we may note that there has been a very real displacement of power and culture from the south-east of Europe to the north-west during the period from, say, 800 B.C. to A.D. 1900. This displacement is suggested by the heavy black arrow, which is the most obvious feature in Fig. 30. It seems likely that there will be somewhat of a shift in the general organization of the British Empire after the recent World War. Britain is too near the complex cultural and national conflicts of the continent to be the ideal centre of British power in the future. If her centre is displaced elsewhere, it is difficult to see what will prevent the focus of European power from shifting still further into the cool north, say to the Kremlin of Moscow.

CHAPTER VI

ARYAN SPEECH AND ARYAN SPEAKERS

The most characteristic feature of the world groups of today is Nationality, so that it is important that we should arrive at a clear idea of what constitutes a Nation. In 1936 the writer published *Environment and Nation*, a book of 500 pages, dealing with this topic; and a few extracts from that volume will help us to link nationality with our study of the evolution of civilization.

Webster defines "Nation" in terms of common descent, language, institutions, independent government, etc. To these criteria may be added well-defined environment, natural centre, tradition, long political association, and defence against common enemies. In the above book I considered how these various factors seemed to have affected nine of the principal nations of Europe, and it seemed to me somewhat obvious that language was the most usual "cement" writing the components of a nation, while religion came second. The ratings were somewhat as follows—one point being given for each nation which conformed. (The maximum figure for any character is 9.)

IMPORTANCE OF NATIONAL CHARACTERISTICS

Character	Rate	Notes
Language	7	Usually a distinct language for each nation.
Religion	7	One of three dominant religions, so less important.
Race	4	As explained earlier, of no real importance in Europe.
Tradition	3	Greece, France, England are examples.
Independent government	6	The criterion here used to be explained later.
Well defined environment	4	Good physical boundaries to a homogeneous area.
Natural centre	3	Such as a capital where main rivers converge.
Defence	4	Switzerland and Roumania are two examples.

Probably no two investigators would agree on these ratings, but no one will deny the great importance of a common language in promoting a community of interests. As someone has remarked, the outstanding socio-political feature in the world of the last century is that England and the United States speak the same language. Though this has not

made them one nation, it has meant that they have a common cultural background, and can readily and rapidly be swayed by the same cultural stimuli, without all the tedious delay due to translation from a foreign language.

To many laymen, nation, race, and language are more or less synonymous. This is a grave error, if only because it has been exploited by the Nazi propagandists in their confused and unscientific attempts to rationalize German world domination. It is hoped that the chapter on race will have made it clear to the reader that there is no necessary connection between race and nation, or between race and language. The former is a biological concept, the two latter are strictly cultural in their origin. One of the most striking examples of this error is a map of Europe, widely distributed in 1918 by a well-known society in Washington. It is entitled "A Race Map of Europe," and gives nearly a score of so-called "racial groups" in Europe. A very short examination of this map shows that the classes marked on the map are purely linguistic, and have no relation to the races, Nordic, Alpine, and Mediterranean, etc., which were discussed earlier.

The title of this chapter indicates that the term "Aryan" is of great importance in our study. How does this come to be the case? The various distinctions involved in the present discussion can be illustrated if we define the four terms "Aryan," "German," "Nordic," and "Jew." Many folk would say that a "German" must be Aryan and Nordic, while a "Jew" cannot belong to any of the other three categories. These statements are by no means correct.

"Aryan" must be used only as a linguistic term. It connotes a group of allied languages, which are spoken by folk dwelling in the western portion of the continent of Eur-Asia, in a belt from Ireland to Calcutta (Fig. 35). Some philologists confine Aryan to the speech of the eastern portion of this language belt; others (including the writer) use it as synonymous with Indo-European or Indo-Germanic. These latter terms, indeed, suggest the wide extent of this group of cognate languages. I believe the word "Aryan" was coined by the German Max Müller. He placed on record his disgust at the use of the phrase "Aryan Race" as follows: "To me, an ethnologist who speaks of an 'Aryan Race,' 'Aryan blood,' is as great a sinner as a linguist who speaks of a 'dolichocephalic dictionary' or a 'brachycephalic grammar'."

What does the word "German" connote? To the writer it means a national who lives in the German Reich in accord with the laws

controlling the said Reich (Fig. 35). A German national may be a Ngero or an Alpine in race. As we shall learn later, probably only a minority of Germans are of the Nordic race; and indeed the Nazis themselves soon had to abandon the idea that no one but a Nordic was of any importance in Germany. Thus in March, 1936, the word "Aryan" was replaced in various decrees by the term "German and related blood." In February, 1939, they found it expedient to improve this again, and used the term "European racial" in place of Aryan. Needless to say none of these three terms, in their opinion, included the Jew.



FIGURE 35.—Map of Europe showing the distribution of Aryan and Altaic languages. The area of the German nation is also charted.

FIGURE 36.—Map of Europe showing the distribution of the Nordic race (dotted), and of the folk who profess the Jewish religion. The Alpine and Mediterranean (M) races are also indicated.

In an earlier chapter we have reached a definite opinion as to what "Nordic" means (Fig. 36). This is a purely biological term, indicating a tall, fair, rather narrow-headed type, usually with gray or blue eyes. This racial group is not found widely spread in Germany, but is characteristic of eastern Britain, north-east Poland, Lithuania, Latvia, Finland, and most of Sweden. No wonder the German ethnologists felt uneasy at Hitler's early emphasis on the virtues of Nordic blood.

Lastly what do we mean by the term "Jew"? Is there a Jewish race? Certainly not. A Jew is a person who subscribes to a very ancient monotheistic religion, which in turn gave rise to Christianity. The opposite of a Jew is clearly a "Gentile," not an Aryan. The original

Jews in Palestine—like those who have since lived there through the centuries—are slender, dark, dolichocephalic people, quite undistinguishable biologically from the Arabs and other folk who also live in Palestine. They are Mediterraneans, and so are all the Jews who have left Palestine and moved to the west along the northern coasts of Africa (Fig. 36). Many of these reached Spain, so that the Spanish Jew (Sephard) is also of pure Mediterranean race.

After the great dispersions around A.D. 100 thousands of Jews moved north from Jerusalem. As soon as they climbed the great scarp to the north of the Syrian plains, they reached a region where the race was entirely different. Here all the folk were Alpine broad-heads. The most abundant variety was the Armenian type, characterized by a rather large hooked nose. Here the Jews intermarried with the much more abundant Alpine stock, and in a few generations their racial character was entirely altered. They became big-nosed Alpines. (Fig. 36.)

From Armenia and allied parts the Jews slowly migrated still farther north. In the eighth century they became numerous in the territory of the Khazar "Scythians" (Fig. 36). These were folk (akin to the Turks of today) who had conquered much of the Ukraine; and who were keen traders in the region between the Caspian Sea and the Polish plains. The Caspian is called *Bahr-el-Khazar* (the Khazar Sea) by the Moslems to this day. About A.D. 740 Khan Bulan, ruler of the Khazars, was converted to Judaism, and made this religion more or less compulsory among his subjects. Indeed later none but a Jew was allowed to reign. Here we find one reason why today such large numbers of Jews in Russia and Poland are racially akin to their Alpine neighbours. Indeed the Polish Jew is *Ashkenaz* (i.e., Scythian) to this day. The Khazar Empire was smashed by the Varangians in 965, and the Jews were dispersed again, many moving into Poland and Lithuania in succeeding centuries. Some slight factor of "artificial selection" no doubt linked the "big-nose" type of Alpine with the Jew; so that there was some slight tendency for this facial character to persist. But the majority of the Polish Jews resemble their Gentile neighbours in race.

Finally, let us briefly examine the peculiarly inappropriate term "Non-Aryan" as applied to a Jew. There is a specific language associated with the Jew, whose name is familiar to all of us. It is Yiddish. We have all seen newspapers printed in this language, and many folk know that Yiddish is written in Hebrew script. But if we write English in Pittman's shorthand, it is still English and Teutonic and Aryan! So

also Yiddish is essentially a medieval German dialect, originally spoken by the most cultured and wealthy Jews of Europe in the Rhineland in the vicinity of Frankfurt. From Germany it spread to Poland and elsewhere. The following phrase will show how close Yiddish is to modern German:

1. *Es is gar alls kein Neues mischt unter der Sunn*
2. There is no new thing under the sun
3. *En kol Hladish tahath Hish shemesh*

The third line gives the above phrase in Hebrew, and anyone without being a philologist can see that the basis of Yiddish is German.

It has been stated that more words in the English language are derived from Latin than from Anglo-Saxon. This does not alter the fact that English is a Teutonic language, since it is the common simple words of everyday speech so determine its allies. So also Yiddish has many words derived from Hebrew and Slav; but essentially it is a German dialect, and by some folk is called Judeo-German.¹ Obviously, therefore, it is as Aryan as German itself; so that there is no sense whatever in calling the Jew a "Non-Aryan." As we shall see later, the few European groups who do not speak Aryan languages are the Hungarians, Finns, and their allies, whose types of speech belong to the Altaic group of Asiatic languages. They are accurately described as Non-Aryans. To sum up, the four names listed at the head of this section and their antitheses are as follows:

	National	Racial	Religious	Linguistic
Term	German	Nordic	Jew	Aryan
Antithesis	British	Alpine	Gentile	Altaic

A Jew may be defined as a member of a composite culture-group with a specific religion; most of the Jews are Alpine in race, and speak an Aryan language (a dialect of German), which is usually written in a peculiar script.

Language is therefore a very important factor in the make-up of a nation; and "Aryan" is a term which belongs exclusively to the linguistic field. We may now turn to certain geographical aspects of languages which enable us to formulate theories as to the origins and differentiations of language, much as we were able to do in the case

¹L. Wiener, *History of Yiddish Literature*, London, 1899.

of race. Let us use the slight differences between English and American (United States) idiom as an illustration of this technique.

The early settlers of New England came mainly from Suffolk and the adjacent east of England. They carried to America the pronunciations of early Stuart times, and some of these have changed considerably since their departure. In the fifteenth century words like *dark*, *far*, *farm*, *star*, etc., were spelled and sounded *derk*, *fer*, *ster*, etc.² So also *clerk* and *new* were pronounced *clerk* and *nou* in this part of England. About the time of Elizabeth the pronunciations *clark* and *nioo* were growing in favour, and have since become universal in England.

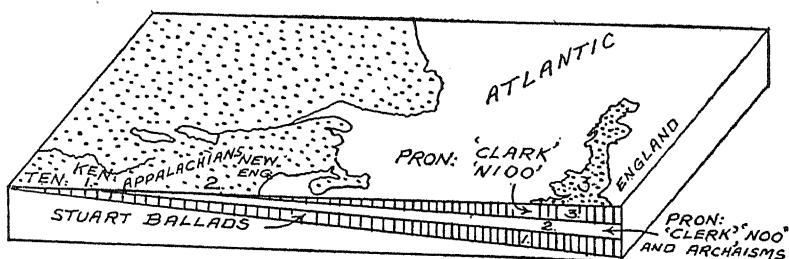


FIGURE 37.—Linguistic evolution indicated by the distribution of early pronunciations and folk-lore, which survive in marginal regions. An illustration of the Zones and Strata concept, in which the strata are shown on the front edge. (From *Environment and Nation*.)

The older forms were carried to America and survive in rustic New England. So also certain Elizabethan and Stuart ballads are perhaps better preserved in the isolated mountain hamlets of the Appalachians than in most of England. Many old words have become archaic in England which are still in common use in much of the United States. Examples are *fall* (autumn), *guess* (think), *sidewalk*, *whittle*, *greenhorn*, *cordwood*, *gotten*, *cracker* (biscuit), *shoat*, etc. Here again, as we saw with race, the primitive is "pushed to the wall" far from the cradleland. No one imagines that Shakespeare lived in the Appalachians because some of his language is perhaps more common there than at Stratford! But many philologists have thought that Sanskrit originated in Lithuania; whereas Lithuanian is a marginal survival of early Aryan (akin to Sanskrit), thrust out from the common cradleland in south central Asia.

²H. C. Wyld, *History of Modern Colloquial English*, London, 1920.

These stages in the evolution of the details of a language are charted in Fig. 37, which illustrates the principle of the Zones and Strata concept fairly clearly. As before we see that the primitive type is pushed to the margin, while the later types appear first in the central cradle-land. Of course conditions have changed so greatly in the United States in the last fifty years that it is now an independent centre of stimulus—possibly the greatest in the world in regard to modern culture—and Britain is borrowing new terms from the United States.

There is one point in my approach to the evolution of language which I have found puzzles many philologists. What is meant in this book by a "higher" language? I can best make this clear by a reference to the biological field. Few folk now deny that the mammals (including man) are descended from some early insectivores akin to the fossil lemurs. It seems to me reasonable to state that man is a "higher" mammal than the lemur, i.e., he is a specialized form only lately branched off from the general mammalian line of descent. There are many lemurs, still living, which are "lower" forms of life than man, since they have not changed much from earlier mammalian types. In most cases the earlier, more primitive forms of the groups are much more abundant in the margins of the Old World than are the later, "higher" forms—as is clear in the case of the lemurs, charted in Fig. 15a.

A biologist, however, can readily instance certain exceptions to the general rule that evolution means a greater ability of the animal concerned to cope with the environment. The evolution of the sac-like *fixed* Ascidian from a free-swimming vertebrate larva is a case in point. However, the curious life-history of the Ascidian does not invalidate the theory of Darwinian evolution.

In languages we find a complex evolution with many points in common with the above process. Many languages, which have developed near the centre of human civilization, such as the Persian and Chinese, are derived from much more cumbrous languages, such as primitive Indo-European or primitive Sinitic. I would say that these modern languages, which have largely lost their inflections, are "higher."

I am told by Dr. R. Ward (of Cornell) that a certain Indian language shows a reversion from a somewhat analytic to the earlier inflectional form. I would class this as "the exception which does not disprove the rule." It is analogous to the Ascidian reversion explained above.

I know that most aboriginal tongues in Australia have countless inflections. It seems to me likely that this was characteristic of most primitive tongues, which, like primitive animals and races, survive with relatively little change in "refuge-areas" where there is little cultural stimulus. Such languages I class as the "lower" types. English is a "higher" language than German, because it has proceeded farther than German along the usual path of language evolution. Here, however, the process of "friction" with Welsh or French has been a further factor in its evolution. In general, primitive languages survive on the margins of a group of related languages, though it is not hard to find exceptions to this general rule.

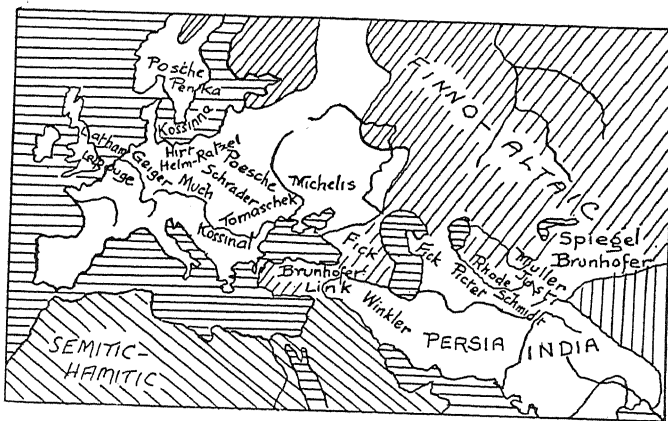


FIGURE 38.—The field of Aryan languages (blank) amid the other great language groups. The twenty-six cradlelands of the "Aryans"—as suggested by the philologists named—are inserted (from von Eickstedt). North Persia seems the most probable site.

CORRELATIONS IN THE DISTRIBUTIONS OF LANGUAGE

Few problems in science are so difficult as those concerning the interrelations of the main language groups. Since here we have to do with an evolving complex arising in something like a cradleland and affected by wide migrations, it seems likely that some light on the subject may be obtained by charting the data as we have already done in previous discussions in this book.

We may commence our survey by considering the conclusions arrived at by philologists as to the original homeland of the Aryan-

speakers. Reference to Fig. 38 will show that every country from the North Sea to India has been hailed as the place where the Aryan languages originated! The writer feels that the geographic approach strongly supports one area, and since this line of reasoning is one never used by the philologists, it may enable us to decide which of the twenty-six learned but disagreeing doctors is correct! The map given in Fig. 38 is somewhat generalized, and shows the distributions of Aryan languages about the time of Columbus. At that period the Altaic-speaking Turks had broken across the Aryan realm in Anatolia, but the Russians had not yet displaced the Finno-Altaic speakers in eastern Russia and Siberia, as is the case today.

It has long seemed to the writer that a slight knowledge of the relationships of the main language groups of the world would be of very much greater value to the average cultured citizen than the smattering of school Latin which so many of us find of no value whatever as a means of reading Latin literature. (All such literature is adequately translated into English, so that the weary hours spent by the writer and his contemporaries with Latin declensions, conjugations, and vocabularies were to all intents and purposes practically wasted.)

The somewhat novel diagram given in Fig. 39 was drawn by the writer in 1920, and has been used by him ever since to illustrate the general principles of language relations. Most philologists use no diagrams whatever; while a few use interlocking circles to represent the way in which one language affects a neighbour. We may show how one language drives another out of its territory, borrows from it, and lends to it, by a comparison with various lava flows welling out of a common fissure. (This is a common geological phenomenon.) Each new eruption (i.e., language) arises from this centre—or near to it—and while covering some portion of the previous flows, pushes most of the previous lavas out to the periphery. Fossil languages, buried under existing tongues, can be shown in section. Relic languages, preserved in mountain districts (as is so often the case), can also be indicated if desired. It must, of course, be clearly understood that the diagram is greatly simplified, and suggests only the general mechanism of language change and migration, rather than a detailed picture of what actually occurred.

From all that has been written earlier regarding the diffusion of races and cultures, it may be taken as axiomatic that the order of evolution of languages in the western portion of the Old World must

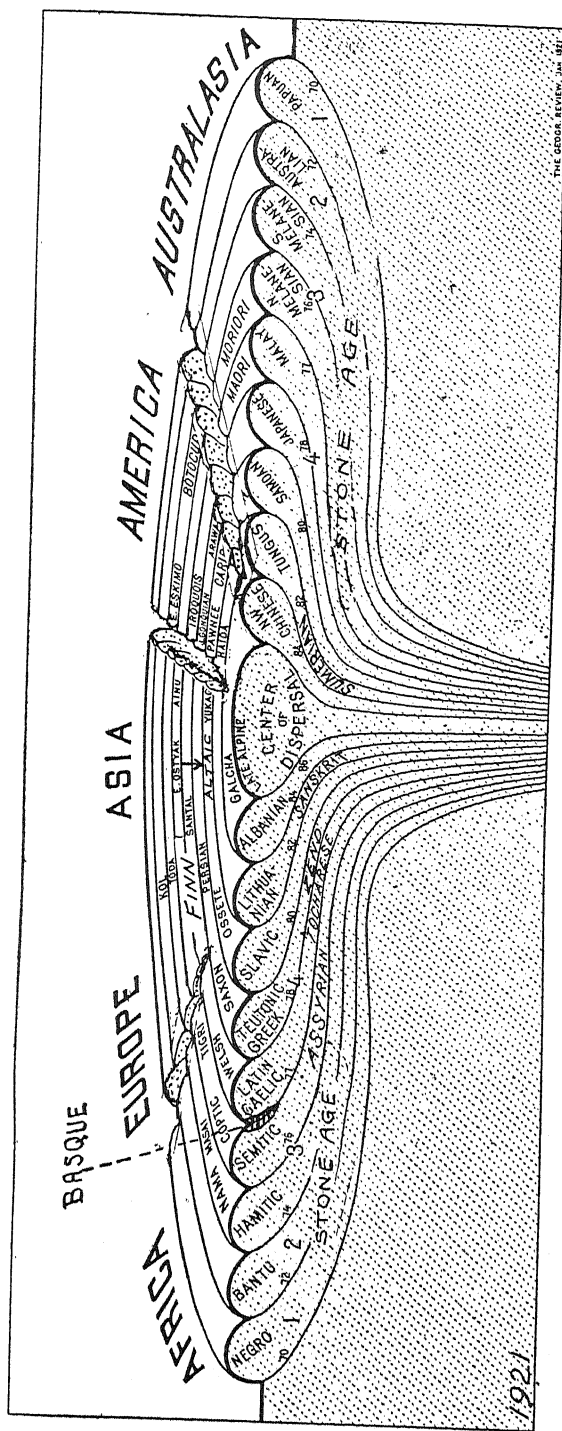


FIGURE 39.—A generalized diagram to show the gradual evolution of the major languages. The analogy is with a series of lava-flows from a common centre. The differentiation due to gradual isolation is indicated by the clefts in the margin. Fossil languages buried under existing tongues are seen in action. (From Geographical Review, New York, Jan., 1921.)

be in somewhat of the following order (the marginal languages being the most primitive, and the central languages the more advanced): Bantu, Hamitic, Semitic, Basque, Sumerian, "Q" Aryan, "P" Aryan, latest (or Satem) Aryan. The problem is, of course, complicated, as in biology, by the fact that independent evolution takes place after the branching of the parent language. Thus it seems likely that Proto-Gothic branched off from the Aryan stock before Sanskrit. Yet English, a descendant of Proto-Gothic, is a more advanced language (i.e., more analytic, simpler, and easier to learn) than is Sanskrit.

The following summary gives simple definitions of the language classes.³ In primitive languages like Bantu, parts of speech were differentiated by the attachment of different relationship words, which however, did not fuse with them. Vowel harmony of all the syllables of such a compound often developed as a means of marking off the phrase. This is *Agglutinative* speech. It survives in the Bantu tongues as a *prefix* type and in the Altaic (e.g., Turkish) as a *suffix* type.

The Hamitic-Semitic group carried agglutination so far that the relationship words *fused* at last with the chief words to which they were affixed or prefixed, and speech became *Amalgamating*. Words were also systematically modified by internal vowel change to give regular alterations of meaning. Dravidian speech is agglutinative—affixing and infixing—so that it is rather generalized, and may be the ancestor of several of the other main languages.

The Aryan group developed external suffixes to indicate variations, and so produced *inflectional* languages. The three groups, Hamitic, Semitic, and Aryan, also tend to rely on relationship words and on word order, and increasingly to neglect word forms. Thus they become *analytic*. There is little doubt in the writer's mind that this sequence (e.g., from Bantu to such an Aryan language as Persian) represents linguistic evolution, in much the same sense as the sequence "amoeba to man" represents zoological evolution. In both cases many groups branch off from the main stem, producing minor, independent evolutionary groups. In both cases some descendants stagnate, while others advance rapidly, as stated earlier.

³A good account of the language groups will be found in W. H. Worrell's *Study of Races in the Ancient Near East*, Cambridge, 1927.

Before Aryan scholars yield to despair because the foundations of Aryan are "wrop in mystery," a promising field would be to explore Dravidian or Altaic for the antecedents of Aryan. For instance, there are three possible explanations for the accepted resemblances of Finnish to Teutonic. The one usually accepted is that Finnish has borrowed from Teutonic. But it is also possible that Teutonic has borrowed some characteristics from Finnish. A third view worth considering is that border (i.e., primitive) languages like Celtic and Teutonic, still retain speech characteristics which have been carried over from the more primitive speech (now preserved as a marginal language zone) from which the Aryan group as a whole evolved. Adopting this view the features common to German and Finnish may be an inheritance from the common mother-tongue of Aryan and Altaic.⁴

The lesson to be derived from the Zones and Strata technique is that marginal languages should be compared with each other. This means that far-distant speeches may be very well worth comparing. I learn from correspondence with Professor M. Schlauch of New York that an Italian philologist, Alfredo Trombetti, arrived at much the same conclusions several years later than myself. In his *Elementi di Glottologia*⁵ he advocates attempts to connect one primitive language group with another. For instance, he shows similarities in the numerals of the Munda (India) and certain African languages; between pronouns in Hamitic and Dravidian; between verbs in Dakotan (Amerind) and Georgian in the Caucasus. The greatest similarities are to be found between groups most widely separated, "on the periphery of a rough circle having its centre in India." This is the same thesis I propounded in 1921; and will be found to agree in many respects with Fig. 39 herewith.

To repeat, from the Zones and Strata technique we should actually expect that Basque would resemble some Amerind language (as some have suggested); that Gaelic would resemble Pharaoh's Hamitic tongue; and that early Sinitic, early Altaic, and early Dravidian (i.e., marginal languages) should be studied if we wish to learn something about

⁴See the article by A. H. Keane on "Ural-Altaic Languages" in *Encyclopædia Britannica*, 11th ed., 1911.

⁵Bologna, 1923.

Proto Aryan. Thus the writer by no means despairs of the solution of the Aryan problem.

These ideas have long been engaging the writer's attention. In 1921 he published a generalized diagram, which was probably the first application of the Zones and Strata concept to linguistics. With a few minor alterations it is reproduced as Fig. 39. Here, as stated earlier, the concept of a central cradleland of culture is adopted. But we must ever bear in mind that we are primarily concerned with events which occurred before 5000 B.C., for all the major language families had differentiated before that period.

The cradleland is represented as sending forth successive flows of lava from a centre of eruption. These form concentric zones about south central Asia, and each flow pushes its predecessor to the margin. The effect of one flow on its neighbour—involving some contact and assimilation—is also rather usefully indicated. The flows reach the four "peninsulas" of Asia (i.e., Europe, Africa, America, and Australasia) according to the relative advantages of the connecting corridors. I have elaborated this concept in several essays already published. As the marginal languages are pushed from Asia into the continents specified, it is obvious that great differentiation, due to isolation, will take place. This isolation is indicated by the clefts at the margin of the diagram in Fig. 39.

For the purposes of this general discussion it will be enough to consider only the main sub-divisions of the Aryan (or Indo-European) languages. The two major groups are the *Kentum* and the *Satem*; so named from the words for "hundred" in Latin and Sanskrit (*Zend-Avesta*). Furthermore the *Kentum* group is again sub-divided according to the interchange of the sounds K (or Q) and P. This can be illustrated by the word for "five" in Latin (*quinque*, the "K" type) and in Greek (*pente*, the "P" type).

Meillet in 1908 divided the languages in a somewhat different fashion. He adopts a western Italic type (Italic, Celtic, Germanic), and an eastern group (Slav, Albanian, Armenian, and Persian). However, the distribution is much the same as in the other classification. In the following table the first-mentioned sub-divisions of the Aryan languages are set out so as to demonstrate their geographical position. The dominant race of the present speakers is given, but it has little bearing on the evolution of the Aryan languages.

DISTRIBUTION OF ARYAN LANGUAGES*

Early Kentum Type		Later Satem Type	
Largely Mediterranean race	Partly Nordic	Largely Alpine	Largely Alpine
Primitive "K" West Europe	Later "P" Central Europe	East Europe	South-west Asia
Old Irish 100 is <i>cet</i> 5 is <i>coic</i>	Welsh <i>cant</i> <i>pymp</i>	Lithuanian <i>szimtas</i> <i>penki</i>	Sanskrit <i>satem</i> <i>panch</i>
Latin 100 is <i>centum</i> 5 is <i>quinque</i>	Greek (He) <i>Katon</i> <i>pente</i>	Old Slavic <i>suto</i> <i>peti</i>	

*The spelling in this table is partly based on R. Ward.

The geographical order given above is indicated on the map (Fig. 41). It will appear in later paragraphs that the primitive Mediterraneans (Picts, etc.) in Britain were driven to the west by the Gaelic-speakers, and the latter by the Brythonic-speakers, and these in turn by the Teutonic-speakers. This leads us to the important conclusion that race and language have both migrated outwards from Asia, though language has moved faster than race. Gaelic, for instance, is today spoken mainly by a few short, dark, dokephs (Mediterraneans) in the Scottish Highlands. We know from the Gaelic place-names in central Europe that Gaelic (or Goidelic) travelled right across Europe from the Carpathians; but we are reasonably sure that there were no short, dark Mediterraneans in central Europe at that time (about 1000 B.C.). Hence Gaelic was probably carried westward by Alpines, and then transferred to the people of Ireland and Scotland by a few Alpine overlords who have since entirely vanished. The same thing can be seen in Haiti, where the Negroes now speak French, which they learnt from a few plantation owners, who were driven out about 1800.

As stated earlier, we can be sure that Gaelic did not evolve amid the Scottish Highlanders. It is by no means clear, however, who first spoke the primitive Aryan language. The word *Wiro* has been coined for this hypothetical tribe. Were the *Wiros* of Alpine or Nordic race? The study of the original roots of the language seems to indicate that the cradleland was an inland country. Schrader in 1863 suggested that Bactria (north of Persia) was probable, and evidence in support of this old theory will be advanced in a later section. This

account is an amplification of data presented by the author before the British Association for the Advancement of Science in 1938.

ECOLOGICAL NOTES ON THE ARYAN PROBLEM

We may use the stage diagram to correlate our scanty knowledge as to the early wave-fronts of the Aryan languages. As mentioned above, there are three fairly definite subdivisions of Aryan: (1) the early Kentum or "Q" speeches, like Gaelic and Latin; (2) the "P" languages like Welsh (with which we may associate Teutonic and Greek, which are in the same *intermediate* zonal position); (3) the later Satem languages like Slav and many Indian tongues.

Turning to Fig. 40, some idea of our knowledge of the language distribution in Sumerian times (about 3000 B.C.) is given in the lowest map of the series. At this time Hamitic languages were used by the Pharaohs in Egypt, akin to those still spoken by the Berbers in the Atlas Mountains. Semitic languages characterized Arabia and Syria, as they still do today. Sumerian itself has some resemblances to Altaic, though its affinities are not clearly understood. In Europe at this early date, there were racial allies of the present-day Hamitic-speakers—all of Mediterranean race—living in the western margins, who probably spoke Hamitic, according to Rhys and Brynmor-Jones.^a Central Europe was occupied by early migrations of Alpine "brakephs" (broad-heads) of whose language we know nothing. It was almost certainly not Aryan, and something akin to Basque seems most likely. This problem is taken up later. In view of the important corridor linking Turkestan with China, by way of the Tarim basin, I have ventured to suggest that a linguistic kinship between early Chinese (Sinitic) and Sumerian or early Aryan is only to be expected.

In the second map (Fig. 40 at B), for the period around 1200 B.C., we are on surer ground. Vast migrations of Satem-speakers had poured into India from Russian Turkestan. The Hittites, who spoke an Aryan tongue of the Kentum group, were in control of Anatolia. Semitic was now the chief language of Egypt and Mesopotamia.

In central Europe, if we adopt the suggestions of H. Peake, Kentum languages were spoken in the regions east of the Alps; while Brythonic (one of the Intermediate "P" types) was the speech of the so-called

^aJohn Rhys and David Brynmor-Jones, *The Welsh People*, 2nd ed., New York, 1900; 4th ed., London, 1906.

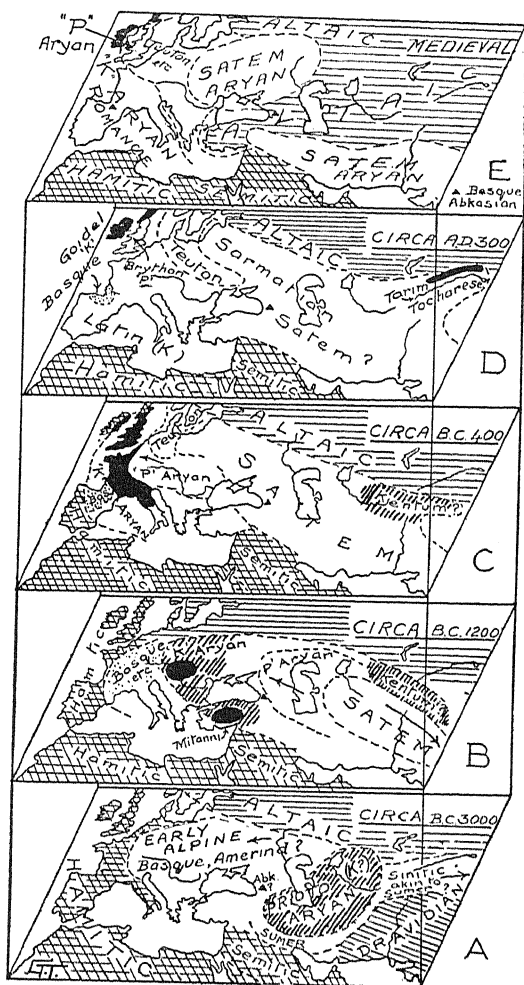


FIGURE 40.—A stage diagram suggesting the spread of the Aryan languages from a cradleland near the Caspian. The lowest map shows conditions about 3000 B.C. It is suggested that the early Mediterranean race spoke Hamitic, and that some of the early Alpines spoke Basque. The latest type of Aryan language to develop is the inner zone, the "Satem" group.

Cimmerians⁷ of the Ukraine and the Caucasus areas. It seems logical to assume that many Satem speakers still remained in Turkestan, and were perhaps allied to the Sarmatian tribes.

In the next map (for 400 B.C.) we see the first great Aryan conquest in the Near East, that of the Persians. They spoke a Satem language, and it is probable that their Sarmatian kin were occupying the European steppes about this time. The latter may have been the ancestors of the Slavs, who already seem to have settled in the Vistula basin. Meanwhile the marginal "K" speeches (Gaelic, etc.) had reached Britain and Ireland, and still occupied parts of France. The distribution of place names in central and western Europe clearly shows the migration of waves of Gaelic and Welsh speakers across much of these areas.

The conditions seven centuries later (A.D. 300) are shown in the next map, which deals with Europe during the zenith of the Roman Empire. The marginal, primitive, Aryan language *Latin* had been carried far and wide; so that it later gave rise to Italian, French, and the other Romance tongues—which are clearly offshoots of the "Q" or "K" zone of Aryan (Fig. 40). Brythonic (Welsh) was spoken in England, south Scotland, and Wales at this time, and probably in parts of the continent besides Brittany both earlier and later than A.D. 300. Possibly some Hamitic dialects still persisted in the Scottish Highlands, as suggested by some interpreters of the Ogam inscriptions. Gaelic (a "K" language) was spoken in Ireland and in most of northern Scotland.

Of great interest is the discovery that a Kentum language, called Tocharian, was still in use north of the Tarim basin in central Asia about this time (Fig. 40 at D). Tocharian seems, however, to have some affinities with the Intermediate and Satem groups of Aryan also. Hence it may well be fairly close to the *generalized* Aryan ancestor from which all three groups have descended.⁸ It is suggested in the diagrams that this Kentum speech had been continuously used east of Turkestan since early Aryan times.

⁷It has been rather doubtfully suggested that "Cimmerian" is cognate with the "Cymry" of Wales.

⁸See V. Gordon Childe, *The Aryans: A Study of Indo-European Origins*, London, New York, 1926. See also the articles by G. S. Lane in the *Classical Weekly* for March 17, 1941; and in *Language* for Jan., 1938.

The medieval distribution of languages, and of the three subdivisions of Aryan, is shown in the top map. Today, Gaelic is almost the sole representative of a little-altered primitive speech, though the much-evolved derivatives of Latin are still very important languages. Hamitic has died out in Europe. Altaic has encroached in Hungary and Finland, and displaced Hittite and Greek in Anatolia. Semitic has driven out Hamitic in much of north Africa. "Satem" Aryan, in the form of Russian, is in turn displacing Altaic throughout much of the U.S.S.R.

If now we glance over the data collected in the five maps in Fig. 40 and concentrate on the marginal "K" type of Aryan (shown in black, or heavy ruling) we see that this "zone" contracts in area as we move back in time. Clearly the centre of the zone of primitive Aryan distributions is the most logical position for the cradle of Aryan speech.

The conclusion to be drawn from this tentative geographical approach to the Aryan problem is that the waves of language have spread from Persia or Turkestan towards India and Europe. There seems to be no support for the origin of Aryan in the German or Lithuanian regions, a theory which for a time was strongly upheld by a number of notable continental philologists.

THE RACE OF THE EARLY ARYAN-SPEAKERS

Let us turn to another aspect of the Aryan problem. What race were the "Wiros," as those who first spoke the Aryan languages have been called? Today Aryan is spoken by three races: by Alpines in central Europe, by Nordics in the north, and by Mediterraneans in the south. There can be little doubt that originally these dissimilar races "despised" each other as bitterly as any pair of ignorant and opposed culture-groups ("cults") do today.

It seems logical to suppose that each of the three original races, coming from rather different environments, at first had a somewhat distinct culture, including language. How can we advance our knowledge of their early history? There are several techniques in use. The oldest method is to study the syntax and etymology of related languages (e.g., Aryan), and learn from their many variations which was the original. Unfortunately, for many years this technique was fatally handicapped by the idea that languages "decayed" by losing inflections—whereas this phenomenon is one of the clearest signs of evolution. However, there can be little doubt that the Kentum languages of the

western margin are closer to the original Aryan than the Satem languages of the centre and east of the Aryan realm (Fig. 40).

Let us use an ecological approach. If we plot these languages on the map, it seems highly likely that the Mediterranean folk of south and west Europe spoke Hamitic (or its derivative Semitic) before they were conquered by Aryan-speakers. The research of Rhys and Brynmor-Jones⁹ makes this entirely probable as regards Gaelic and Welsh. But our chief interest concerns the original speech of the Nordics. It is usually taken for granted that they spoke Aryan, of a type not far from Proto-German. I do not know any better reason for this belief than the fact that it is a tenet of those who uphold the Nordic fetish. We have seen that it is possible that the marginal European of the south-west originally spoke Hamitic. Let us apply the same reasoning on the northern margin of the Aryan realm. Here dwell the Nordics—and it is very important to remember that many of the Finns are Nordic, as are some of the northern Asiatic peoples, such as the Ostiaks of the Yenesei. These Finns and Ostiaks speak Altaic. Applying our general ecological law of linguistics, we should expect that some marginal languages (e.g., Altaic) have been replaced by later languages (Aryan) migrating from the cultural cradle.

It is very significant that some of the characteristic features of the Teutonic group of Aryan remind one of similar features in the speech of the Finns and Ostiaks. For instance "strong" verbs like those of German (and English) are quite common in Ostiak. Moreover, Finnish and Ostiak have more inflection and less agglutination than most other Altaic tongues.¹⁰ There are therefore some grounds for the suggestion that the Nordic folk of Germany and Scandinavia originally spoke an Altaic language (like Finnish or Ostiak); and only relatively late in linguistic history learnt an Aryan tongue. Indeed there seems little doubt that the earliest known Nordics of central Sweden, like those of Finland, spoke *Finnish*, not Teutonic. This speculation as to the ancestral tongue of the "Blonde Overlords" is not likely to be acceptable in Teutonic circles!

Margaret Schlauch in her recent book *The Gift of Tongues*¹¹ has

⁹The Welsh People.

¹⁰See A. H. Keane, *op. cit.*

¹¹New York, 1942.

a very interesting section on this problem, from which I quote the following:

Most scholars look to the contemporary peoples of Europe, India or Persia, to find lineal descendants of those who first spoke Indo-European (i.e., Aryan). Yet two well-known authorities, Sigmund Feist (a German) and Vendryès (a Frenchman), have argued that even the Germans of today—who usually claim that honour—do not have the blood of the parent tribe in their veins, even though they speak an Indo-European language (which they now choose to call Aryan). Feist and Vendryès point out that German (and its allies) shows a very great change from the parent speech which lies back of the other Indo-European offshoots. The Germanic group made a complete shift of certain consonants; such as “f” for “p” in *Fisk* for *piscis*, and *Vater* for *pater*, etc. The reason is that the primitive German tribesmen were an alien race trying to pronounce an Aryan language. If this theory is sound, the Germans of today would be a Non-Aryan group speaking a language imposed on them by conquerors in prehistoric times.

The Basque problem has intrigued philologists for a century. The language is quite different from Aryan, but has some slight affinity with three distant groups, Abkasian in the Caucasus, Altaic, and certain Amerind (i.e., American Indian) tongues. So far as I know, no one but myself has suggested any satisfactory reason for the relation between Basque and Amerind. Yet if we study the zones and strata of Europe there is one curious feature.

Harold Peake in his book *The Bronze Age and the Celtic World*¹² has suggested that the earliest Aryan tongues (Gaelic, etc.) reached Europe from Asia by way of tribes of Alpine race about 1500 B.C. But there were folk of Alpine race in Europe for some four millennia before this period; for instance, all the Danubian peoples who moved across Europe in the third millenium B.C. (Possibly there were others still earlier, as, for example, the broad-headed men of Ofnet, who may go back to Aurignacian times.)

What did these forerunners of the Alpine people of today speak? Look farther afield to the other side of the Old World (Fig. 20). It is generally believed that at this date (say, the sixth to the third millennium B.C.) hordes of Amerinds were pouring into North America from central and east Asia. As I showed in 1919, they were of much the same race as the Alpines entering Europe about the same time. I suggest that these very early Alpine invaders of Europe were members of the same linguistic zone, and spoke something like Proto-Basque.

Later, Europe was invaded by the last-evolved group from the

¹²London, 1922.

Asiatic cradleland, who spoke Aryan. These Wiros transferred their languages to almost all the other tribes in Europe excluding the Basques (and perhaps the Finns). In the rugged valleys of the Caucasus relics of pre-Aryan languages, such as Abkasian, seem also to have survived. In its syntax it resembles both Basque and many Amerind tongues. Abkasian is shown (by a black triangle) in Fig. 40 at E.

Following the principle of "doubt and deduce," which the scientist should ever keep in mind, I venture to sow many seeds of linguistic heresy which I hope will prove fertile in the minds of some future researchers. Let us consider the typical marginal languages of Europe, i.e., Gaelic and Welsh. It seems to be rather generally believed that these have always been spoken by the dark Highlanders and their allies of Mediterranean race in Wales and Ireland. A great deal of natural pride is based on the belief in this age-long association.

Our Zones and Strata theory suggests that these marginal peoples only recently learnt these languages from entirely different races. The writer believes that Hamitic speech (akin to the language of the Pharaohs) was spoken in most parts of Great Britain and Ireland, while the Greeks were learning Homer. The Berbers, Tauregs, and other still more marginal folk of north Africa, are of the same Mediterranean race; and still preserve their old Hamitic speech without change (Fig. 40). It is to be hoped that Berber will not replace Erse, and be made compulsory for the unfortunate youngsters in the Irish Free State, as the result of this suggestion!

As regards France, we have very little knowledge of the languages spoken as late as 300 B.C., which are called Gaulish. Study of the migrations of Kentum Aryan shows that the western tribes probably spoke something close to Gaelic—but intermediate between this speech and Latin. The writer has never been satisfied with the general belief that French is *entirely* a derivative of Latin. If the western Gauls used the same linguistic roots as did the Romans, why is not French to some extent based on *Gaulish* roots, with the presumed characteristic suffixes, etc., worn off according to the usual development of a language?

I may make my point clearer by an exaggerated analogy. Supposing we knew as little of the English language before 1750, as we know of Gaulish; we should be far from correct if we assumed (because English resembled German) that it was largely due to the Hanoverian culture of that date. The link is, of course, far back in the sixth century, when the Anglo-Saxons entered Britain.

Few developments in world history are more remarkable than the spread of the Romance languages, which are, of course, largely based on Latin. It is well to realize that Latin is one of the most marginal, and therefore one of the most primitive, of Aryan tongues. Otto Jespersen¹³ pointed this out many years ago; but it is not a fact upon which classical scholars dwell! Some philologists still maintain that the striking change from Latin to French, and from Anglo-Saxon to English, is one of "decay." They would seem to deplore the loss of the cumbrous and countless inflections. A study of language distributions would show them that the languages still more marginal than Latin have even larger developments of inflections. For instance, they are peculiarly abundant in Australian aboriginal speech and in certain west African languages.

I venture to predict that philologists, in time, will accept the following general ecological and cultural "law": "Marginal languages are primitive, and characterized by cumbrous inflections; they evolve by loss of inflections, and by the development of an analytical character; this gradual change is illustrated by the concentric zones of actual languages." This "law" was pointed out by the writer in a tentative discussion of language evolution in 1921¹⁴ when the general key to the whole process (suggested in Fig. 39) was first published.

¹³*Progress in Language*, London, New York, 1894, p. 36.

¹⁴"Evolution and Distribution of Race, Culture and Language" (*Geographical Review*, New York, Jan., 1921).

CHAPTER VII

LANGUAGE AND RELIGION AS AFFECTING THE EUROPEAN NATIONS

ONE of the most interesting phases of history deals with the period of the Dark Ages, say from A.D. 400 to A.D. 800, when the western Roman Empire had crashed and the nations of the future had not yet firmly established themselves in the regions which they now inhabit. The writer has been accustomed to discuss this period in terms of the linguistic zones mentioned in the preceding chapter. Since this is a technique not usually followed, it may be elaborated a little in this chapter.

In a very general sense we may picture four or five tribal zones in the west and centre of Europe during the early days of the Roman Empire (Fig. 41). In the far west it is possible that some Hamitic-speakers still lingered in the west of Spain and Portugal, and perhaps in parts of Ireland and Scotland. The realm of the Basques was, of course, much wider than it is today. To the east of this zone of non-Aryan languages we have five Aryan zones on the map. The most marginal was the "K" Aryan mentioned earlier. It included Gaelic (i.e., Erse) and Latin, some of whose common features are given in the following table:

ANALOGIES OF LATIN AND GAELIC

English	Gaelic	Latin
Father	-Athair	Pater
Full	-Lan	Plenus
True	Fir	Verus
Genitive	with -i	with -i
Neuter stems	with -o	with -o
Future	with -b-	with -b-
Passive	with -r-	with -r-

Quiggin states that the thirty inscriptions surviving from the ancient Gaulish peoples enable us to reconstruct much of the old system of

declension, which resembles Latin very closely on the one hand, and on the other resembles the forms which are indicated for Old Irish.

Within this outer zone is another marginal zone, in which the change from K (or Q) to P had taken place in many words. For instance, *Mac* is the Gaelic form meaning "son of," and this in Welsh becomes *Map*, as seen in *Mappin*, or in *Map-Rhys*, later *ap-Rhys*, and today *Price*. In the south we find a similar change, as shown by the form *Pompey* (i.e., the fifth son) which is the Umbrian ("P" Aryan)

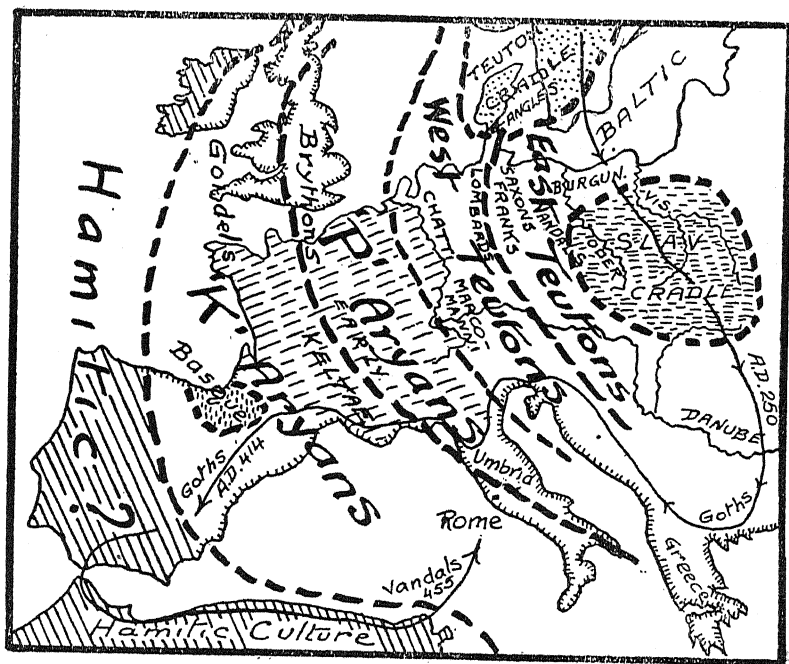


FIGURE 41.—Diagrams of the chief language zones during the period of the Roman Empire. (N.B. These conditions did not all obtain at a given period.)

form of a word that in marginal Latin ("K" Aryan) was *Quintus*. Thus our second Keltic zone comprises Welsh, Umbrian, and other allied languages, which are labelled Brythonic in the map (Fig. 41).

On the inner side of these zones we have the Teutonic languages and cultures. These it is convenient to divide into western Teutonic

and eastern Teutonic. Finally, on the inner eastern side of all our culture-zones we have a vast body of tribes who were the ancestors of the Slav peoples. In the present section I wish to point out what was the destiny of these barbaric folk. Some rose to such power that they dominated more than a continent. Some flourished for a few centuries, and then vanished. Others left little more than a name in local history.

About 500 B.C., as mentioned earlier, the Latin tribe at Rome was of very little importance; and was merely one of numerous groups speaking "K" Aryan, of whom there were many in the zone extending from Italy to Ireland. Among these were the Gauls under Brennus, who attacked Rome in 390 B.C. Almost certainly by this time some of these tribes had colonized Ireland and probably much of England, though this latter point is debated by some writers. From place-names, we know that these Goidelic folk occupied western France, where the Sequani were a well-known tribe of this zone.

Linguistic and cultural allies lay to the east in the shape of the Brythons and other speakers of "P" Aryan. They reached England about 300 B.C. By the Romans all these folk were labelled Keltae, and they naturally formed the tribes against whom the Roman Empire pressed as it expanded to the north-west. The Brythonic Keltae of France had many kindred tribes in the eastern part of Britain who were the dominant people from about 300 B.C. until the Roman Conquest about A.D. 40. It should never be forgotten that there was no "England" until the invasions by Angles and Saxons during the sixth century A.D. Before that Britain was part of Wales, for the natives of Britain during the Roman occupation (which lasted till the legions were recalled about A.D. 400) spoke Welsh, and had never heard a word of English. So also during the fifth century (of which we know so little) the defence of Britain by the rather unmilitant population under Arthur and other leaders was undertaken by a culture-group who may fairly be termed Welsh.

Let us now consider the national destiny of these two groups of Keltae (Goidels and Brythons). The whole of their continental territory was overrun by the Roman armies under Marius, Caesar, and other generals. They were accepted later as full citizens of the all-powerful Roman Empire, with the result that their specific culture almost vanished. Only in Brittany was it preserved to a considerable degree, remaining more or less distinct from that of the Romans, and

later from that of the Frankish Empire, until as late as 1491, when a marriage united Brittany to the French crown. Of course the culture had become almost wholly French several centuries before this union; but the Breton culture-group is distinguished by speaking a Keltic language to this day. It is stated that there was even some indication of a Breton Irredentist party after the recent fall of France.

Across the Channel we find today only small minorities who can speak the ancient Erse (with its close ally, Gaelic) and Welsh. The attempt to make all the young people of Eire learn Erse seems to be meeting with little success, though Erse is still spoken in the west of Eire. In the north of Scotland Gaelic is spoken by many of the western Highlanders; and it is of some interest that a Gaelic newspaper is still published in Canada for the Highland colonists and their descendants who have been in Nova Scotia for over 150 years. Welsh seems to be on a somewhat firmer basis in western Wales, where it is spoken in larger towns perhaps than is Gaelic in the Keltic centres of Ireland and Scotland. However, only in Carnarvon, I believe, are there a few inhabitants who know no English at all.

What was the destiny of the Teutonic culture-zones? Julius Caesar initiated the policy of keeping the Teutons to the east of the Rhine, and he protected the Keltae against the raids which had been a menace to them before the Roman occupation. As Rome became stronger its armies attacked the Teutons until the Romans were decisively defeated, as mentioned earlier, at the battle of Teutoberg. For several centuries the Teutons in vain wasted their strength against the western bulwarks of the Roman Empire in Gaul. We may without much exaggeration say that the Chatti and Marcomanni (Fig. 41) spent themselves in this struggle; at any rate, these western Teutons made no great mark in European history, and no nation has developed from their stock.

During these troublous times another Teutonic tribe, the Goths, left its homeland of Gothland in Sweden (Fig. 41). About A.D. 100 they crossed the Baltic and marched into the German plains, where no doubt they conquered and enslaved certain Slav tribes. From 250 to 269 they were continuously attacking the Roman Empire near the lower Danube. They were in part displaced by the Huns in the middle of the fourth century, and wandered south and then west until they reached the south of France about 410 and Spain in 414 (Fig. 41). The Vandals—

coming from the north German plain by a more direct route—had reached Spain a few years earlier.

Both these Teutonic hordes, however, were numerically much in the minority compared with the short, dark, native Mediterranean stocks of Spain and France; and have left little impression on these lands except for the place names of *Catalonia* (i.e., *Gotalonia*) and *Andalusia* (i.e., *Vandalusia*). Perhaps we may generalize a little and assert that Teutonic tribes wandering far from their native lands, into environments very different from those in which they originated, in no case have given rise to permanent nations. The Vandals lasted only about a century in Algeria, where their empire ended in 534. The west Goths formed a nation in Spain for about three centuries, but they were conquered by the Moors in 717, and nothing of their stock remains. The east Goths had an even shorter rule in Italy, from about 493 to 550. They were driven out and dispersed by the Byzantines in the latter year.

THE DESTINY OF THE NORDIC TRIBES BETWEEN THE ELBE AND THE VISTULA

Of the four culture zones in western Europe shown on Fig. 41 we have learnt that the two western zones gave rise to no powerful nations, though their languages are still in use among important cultural minorities in Ireland, Scotland, Wales, and Brittany. So also a number of the western Teutonic tribes whose misfortune it was to struggle against the Roman Empire at its maximum strength, or alternatively to wander too far from their homelands, left no very permanent impression on the nations of Europe. Very different was the destiny of a number of very similar tribes living near the mouth of the Elbe or in the basin of the Vistula. It seems likely that all these peoples had two factors in common. First, they inhabited a forested tract of sandy plains, diversified by enormous crescentic ridges of morainic material, left by the retreat of the ice front of former times. Between these west-east ridges there were wide deep channels, once occupied by the thaw waters of the ice front; and in many cases clusters of lakes remained, as they still do around Berlin and in the Mazurian Lakes of East Prussia. Secondly, judging from the present racial maps, they must have consisted largely of Nordic stock, though (*vide* Coon) there were large "Borreby" minorities of big-headed survivors from the Paleolithic, who perhaps were there before the Nordics arrived from southern Siberia.

However, culturally there was a sharp division between the western and eastern portions of this exceptional breeding-ground of nations. In the west were the Teutonic tribes of the Angles, Saxons, Franks, Lombards, and Burgundians, all of whom made a considerable impression on European history. In the east were the Slavs, who at the dawn of history lived in the forests and swamps of the middle Vistula. From this latter stock is derived that great series of Slav-speaking nations whose evolution is without doubt the outstanding cultural development in Europe and north Asia. As we shall see it may well turn out to be even more significant than the evolution of the British Empire with its offshoot the United States.

The main period of the "Folk-Wandering" extended from about A.D. 400 to A.D. 900, an interval of five centuries. During this time there was great turmoil throughout Europe, with civilization relatively undisturbed only in the extreme margins, i.e., around Constantinople at the heart of the eastern Roman Empire, and away to the west in the distant island of Ireland, which was left almost free from the major barbarian attacks. In Fig. 42 some seventeen of the chief migrations are shown. The outstanding feature is that no less than fourteen of these originated in the northern plains. Half of these were Teutonic invasions of the Roman Empire—which is shown by the diagonal rulings. Half were Slav migrations (shown dotted) which moved to the south-east and east. In migrating the South Slavs invaded the Roman Empire; but the Czechs, Russians, Ukrainians, and their close allies the Ruthenians never approached the Roman Empire. Those Slavs who stayed in the cradleland ultimately gave rise to the Polish nation.

It is impossible to give any simple answer as to why some of these seventeen migrations produced long-lived nations while others did not. We may, however, discuss their history briefly with a view to understanding the problem. Perhaps the earliest of the migrations was that of the Czechs. They moved into the well-defined Bohemian basin, which is surrounded by elevated blocks of the crust shown on the maps as the Sudeten Mountains, and the Ore Mountains, etc. (Fig. 42). The land was practically empty early in the fifth century, and for one reason and another the Czechs were left to develop this area without much molestation in the early days of nation-building. They are now the western bastion of the Slavs, for the Teutons have driven the other Slavs slowly to the east from the Elbe which was their limit around A.D. 400.

The Burgundians afford a very interesting example of a nation which had an independent existence for a thousand years, and then vanished as such. They were a Teutonic tribe who were deflected into the rather empty lands around Lake Geneva before the Roman Empire was disrupted by the Franks (Fig. 42). Here they soon changed their Teutonic culture, adopting that of the Roman Empire. Burgundy was the central portion of Lothar's short-lived realm created after the first

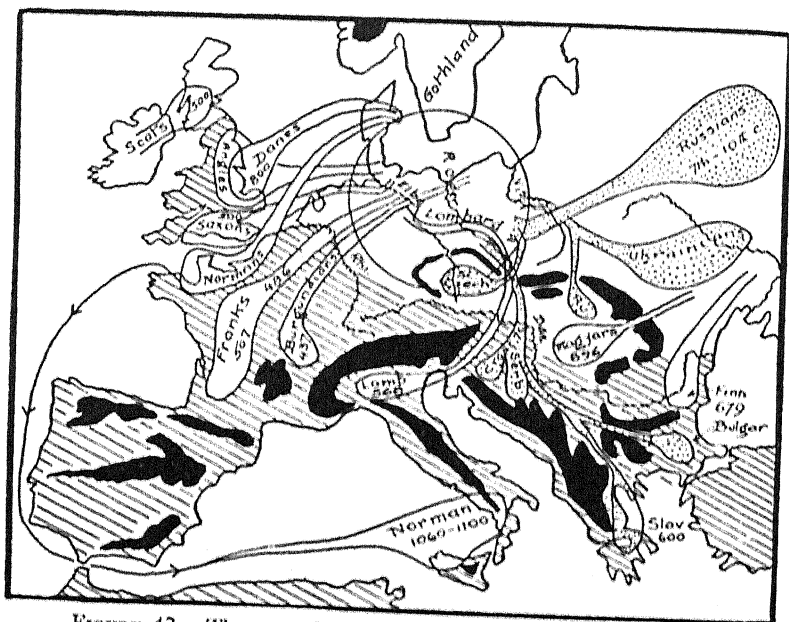


FIGURE 42.—The most fertile breeding ground of nations is indicated by the circle in the northern plains. Here all the migrations shown (except three) originated. Slav migrations are dotted. The diagonal ruling defines the West Roman Empire. The main mountain areas are shown black, thus emphasizing the chief corridors of migration.

partition of Charlemagne's empire in A.D. 843. During the feudal period it was held by the Dukes of Burgundy as a fief of the French crown. When Charles the Bold was at the head of the greater Burgundy—which extended from the North Sea to Lake Geneva—he undoubtedly planned to make himself head of a realm as powerful as that of France. He nearly succeeded, but his plans were brought to naught at the battle of Nancy in 1477; and thereafter Burgundy merged into the huge empire of the Hapsburgs. This often-varying realm of Burgundy was

probably too unwieldy to endure against the opposition of France on the west and the Holy Roman Empire on the east. It had no very natural centre, and certainly no well-defined physical ramparts. There was not much cultural affinity between the Nordic burghers and clothiers of the northern lowlands, speaking Flemish and Dutch, and the agricultural population with a French culture and entirely of Alpine race in the southern part of Burgundy. In a word its chance of survival as a nation was much less than that of the homogeneous Czechs in the natural fortress of Bohemia.

Why did the Franks survive and found a nation which has had a greater effect on the development of western Europe than any other? They were relatively near to their cradleland near the mouth of the Elbe. They rather rapidly acquired the Roman culture, including the garrison-Latin speech which became French. Probably the major factor was their early command of the Paris basin—one of the best-defined regions in Europe, with Paris as the natural centre to which the main tributaries of the Seine and the Loire are directed. On every side but the north-east the growing realm of France was protected either by the sea or by high mountains.

After the English were finally thrown out (about 1429), the French rulers had one main aim—to push the French boundaries east so as to use the ancient defence of the Roman Empire (the Rhine) as the north-east boundary of the French Empire. The creation of Belgium as a buffer state consequent on the struggles between Austria and France (1790-1815) resulted in the creation of a strong and apparently well-protected bloc of French culture. This was based on the proud tradition of the West Roman Empire, the Frankish Empire of Charlemagne, the glorious days of Louis XIV, and the great conquests of Napoleon. No other European nation has perhaps such a striking military record, and this was naturally an incentive to aggression in the days of national rivalry, though we may hope for higher standards in the future.

Lack of space prevents our discussing all the remaining migrations shown on Fig. 42. The Lombards occupied most of Italy for the period from 568 to 774, yet they left hardly any evidences of their sojourn in the racial make-up of the present Italian nation. We have no very clear knowledge of the numbers included in these migrations and conquests. Most of the hordes involved in the folk-wandering numbered less than 100,000; perhaps the average one numbered only half that. These over-

lords could conquer a non-military population readily, but would soon be merged in the much greater numbers of the earlier population.

Since the Slav migrations to the south, which occurred chiefly in the sixth and seventh centuries, produced culture- or race-groups which have survived, it would seem logical to assume that they involved much larger numbers than those of the Lombards, etc. It is true that the Slavs who entered north Greece about A.D. 600 soon lost their Slav tongue and adopted Greek; but the racial character of the north Greeks is Alpine (brakeph), and distinct from that of the much darker (dokeph) stocks who build up the Greek populations on the southern coasts of Greece. These are often pure Mediterranean in race. So that here a racial change seems definitely to have resulted from the Slav folk-wandering.

The South Slavs of today occupy territories which they reached in the seventh century. In the northern region of the Vistula there were Slav tribes known as the *Chrobats* and *Sorabs*. These were transferred to the south either by their conquerers the Avars—or as some say by the Byzantine emperor—and the names they bear today of *Croat* and *Serb*, are the same as they used in their far distant northern cradleland (Fig. 42). These folk were so numerous that they preserved their northern Slav language. So also a kindred group moved to the south-east into the broad valleys of the Maritza (in Bulgaria). Here they were conquered by the barbarian Bulgars coming down from the steppes of the Ukraine. These Bulgars spoke a Finnish (or Altaic) language, but this soon gave way to the Slav language of the more numerous peasants. We see much the same thing in England when the Normans conquered the English-speaking Saxons.

We have no real knowledge of the early migrations of the Russians and Ukrainians into the vast plains of Russia. This part of the world was far removed from the historians of the Roman Empire. Missionaries did not visit Russia until about the year 960. In the seventh century the steppes were in the hand of the Khazar Scythians—people allied to the Turks and speaking an Altaic language. To the north the forests were mostly sparsely settled by Finnish tribes, also speaking Altaic, but perhaps of Nordic race. About the eighth century streams of Slavs entered Russia from the Vistula, and perhaps from the middle Danube also. In the ninth century they reached the western portions of the central uplands. Their attack on the forest and steppe environments was much like that occurring during the settlement of the central part

of the United States. Indeed it was not till 1750 that the steppes east of Stalingrad were occupied, so that this Russian migration took place about the same time as the American movement into the prairies. A discussion of the growth of the nations in north-west Europe will be found in the next chapter.

RELIGION AND THE EUROPEAN NATIONS

One of the most potent factors in the development of the various nationalities of Europe has been religion. When the Roman Empire

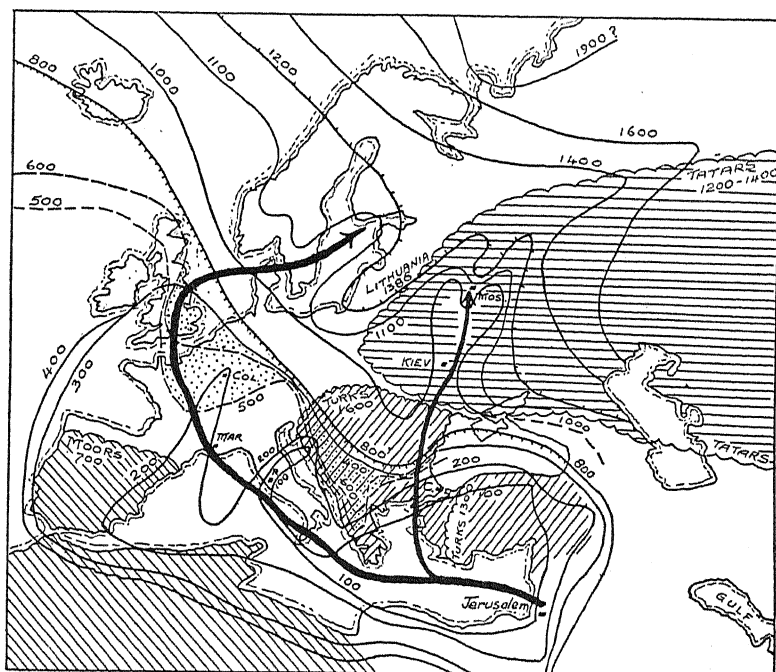


FIGURE 43.—A generalized map showing (by isopleths) the advance of Christianity into Europe. The heavy black arrows show the main corridors of conversion. Dotted areas show the pagan invasions about 500. The three later conquests by Moors, Tatars, and Turks are indicated.

dropped the torch of civilization it was picked up by the young Christian Church. In Fig. 43 I show by means of isopleths (lines of equal distribution) the gradual conquest of Europe by the Christian religion. There are a great many features of interest which can be

readily followed from a study of these isopleths, which, in the writer's opinion, offer an univalled method of acquiring rapidly and coherently the salient religious facts which are essential in our study of the spread of European civilization.

The isopleths show us clearly what we should expect, that new ideas follow the usual corridors of migration and of commerce. (I have ignored the spread of Christianity into western Asia.) During the lifetime of the Apostles, the creed spread along the main route of the Roman Empire from Jerusalem to Rome. Peter died in Rome, as did the great protagonist Paul, who of course had not heard Jesus himself. If we follow the isopleth marked "100" we shall see that it includes most of Anatolia (Asia Minor), and that a "loop" extends far to the north-west to reach Rome. At the end of the second century, the isopleth "200" includes the coasts of Africa and much of Italy. Here again there is a characteristic "loop" extending up the Rhone valley in France as far as Paris and Cologne. This loop is the famous corridor of culture, of such importance in the development of western Europe that it is often known as the "Way of Light." It explains the tremendous importance of the three towns of Cologne, Treves, and Mainz in the early history of that part of Europe. They were the sites of the earliest churches near the Rhine, and had a corresponding influence in medieval Europe; as, for instance, in deciding the election of the emperor.

About the end of the third century Christianity was adopted by the Emperor Constantine as the state religion. Christianity, of course, spread rapidly throughout the Empire, and the "400" isopleth agrees pretty well with the boundary of the Empire, i.e., the Rhine-Danube line of defence (Fig. 43). Unfortunately during the ensuing Dark Ages the realm of Christianity actually contracted, as suggested by the isopleths. During the fifth and sixth centuries the Christian leaders could have been excused if they had felt the Faith might not withstand the pagan assaults on the north and the south.

The Franks who invaded France at the close of the fifth century under Chlodwig (Clovis) were not Christians, though many of them were converted about 500. The dotted area shows the region which was temporarily lost in north France. So also the Anglo-Saxons were strongly opposed to the Christian faith during their early onslaughts on England. During the sixth century it was the Welsh in Wales and the Irish in Ireland who kept Christianity alive in the British

Isles. Indeed the Irish Church sent many missionaries to the Continent during these critical years. St. Augustine arrived in Britain in 597, and the rivalry in Britain between the newly established Roman Catholic Church and the older Irish Catholic Church was settled at Whitby in 664, largely in favour of the church introduced by Augustine.

Around the year 600 there were great pagan invasions of the Balkans, as described earlier. These are suggested by the dotted area in the map (Fig. 43). This wedge of pagans had much to do with the schism between the Church at Rome and the Church at Constantinople. The latter city was a much more important centre of Roman and Greek civilization than Rome, after Constantine made the new eastern city his capital in 330. Conflicts between the two branches of the Church became more and more bitter until 1054, when Pope Leo excommunicated his opponents in the Greek Church. After this date there was little communion between the two great Catholic churches.

Meanwhile the Moslem power was growing to the south-east of Europe. When Mahommed died in 632 he was in command of the whole of Arabia. His great general Khalid defeated the Byzantine armies in 634, and the Persian armies in 637. In a decade or two much of eastern Asia Minor and all Palestine were firmly in the hands of the Moslems. During the seventh century the armies of Omar and Okbar conquered north Africa, and were ready to invade Spain. Quarrels among the Goths in south Spain led to the invasion by the Moors in 711; and Musa soon conquered the whole peninsula, except the mountains of the north-west. Charles Martel and the Franks saved France from Moslem domination at the battle of Poitiers in 732. But the Moors controlled most of Spain until about 1200, and were the chief settlers of southern Spain until the time of Columbus. The region of considerable Moslem domination is shown (by the ruling) in the south of Europe in Fig. 43.

After about the year 800 (whose isopleth is emphasized in Fig. 43) the expansion of Christianity became more rapid. As suggested by the two heavy arrows in the chart, there were two main "corridors of conversion": one leading up the Baltic from Rome via France, etc., and the other leading into Russia from Constantinople. By 1100 the south of Scandinavia was Christian, as were most of the German and Polish regions. In many cases there was a similar procedure involved in these conversions. A powerful pagan prince married a cultured princess from

one of the Christian countries. She influenced the court in favour of Christianity, and usually her children were educated in the Church. This happened in the nations of England, France, Bulgaria, Russia, Bohemia, and no doubt in many smaller groups.

The trade of the Balkans and Russia was naturally rather with Constantinople than with Rome, and this explains which countries adopted the Roman and which the Greek type of Christianity. Moscow became Christian about 1100, but the region to the north was held by the fierce Lithuanians in their forested moraine ridges; while to the south-east were the open steppes not favoured by the Slavs, and held by pagan Petchenegs who followed the Khazars and Magyars from southern Siberia.

About the year 1204 the first of the great Mongol (or 'Tatar') invasions swept into eastern Europe. In 1237 Batu, a grandson of the great Jenghiz Khan, attacked Russia at the head of 300,000 men. He conquered the whole country except a north west section around Novgorod. In 1380 the 'Tatars' were defeated at Kulikovo; and by 1557 Sarai, the old Tatar capital (near Stalingrad), was captured by the Russians. But this period of nearly four centuries, in which Russia was struggling against an Asiatic conqueror, sadly retarded the growth of a European civilization in the eastern plains of Europe. Russia, indeed, until long after the times of Peter the Great (1672-1725), was more akin in many ways to an eastern nation ruled by a despot than it was to the more progressive nations of western Europe. The area overrun for nearly four centuries by the Tatars is shown by the horizontal ruling in Fig. 43.

Meanwhile the last stronghold of paganism in central Europe persisted among the Lithuanians. However, in 1386 these warlike tribes joined the Poles to make common cause against their enemies the Teutonic Knights of the Baltic shores. Jagiellon their leader married Jadwiga the ruling princess in Poland, accepting Christianity as part of the bargain. The combined Polish-Lithuanian territory about this time extended from the Baltic to the Black Sea, and many Poles of today think that much of this huge area should be brought back under Polish control. After 1400 Christianity slowly expanded through the forests and steppes of eastern and northern Russia. However, it is possible that in the far north there are still some Samoyede tribes who are not far removed from the pagan animism of their forefathers.

It will be noticed on Fig. 43 that the Balkan region is cross-ruled

to show interference with the steady progress of Christianity. This indicates the conquest of south-east Europe by the Ottoman Turks during the fourteenth to the seventeenth centuries. The Seljuk Turks moved from Merv to Baghdad in the eleventh century, and defeated the Byzantines at Manzikert in Armenia in 1071. In 1225 about 50,000 Turks migrated into Bithynia (in north-west Asia Minor), and here gave rise to the Ottoman Turks. In 1354 the warring Greeks in Constantinople called in the Ottomans to their aid, with the usual result that the invaders declined to retire. For nearly a century the Greeks of Constantinople controlled little but the territory round their city, while the Turks advanced through Macedonia and Bulgaria to the Danube. In 1453 Constantinople fell, and in 1546 the Turks defeated the Magyars at Mohacs; thereafter they controlled most of the middle Danube plain. By 1683, when their territory was at its greatest, they ruled as far north as Podolia in south-east Poland. This large area is indicated by the diagonal ruling in Fig. 43. During the next two centuries the Turks were gradually driven out of Europe, until by 1913 they held only the region around Constantinople (now called Istanbul).

The Turks were fairly tolerant of the Christian churches in south-east Europe, being chiefly interested in the prompt payment of heavy taxes. However there is no doubt that their control greatly retarded the progress of European civilization in the Balkans; though it is but fair to remember that they gave the Spanish Jews a refuge when they were thrown out by the Christians of Spain around 1492. Only in one region have the Moslems left a permanent impression, and that is in Bosnia. This strange conversion to Islam merits our attention.

About the fifth century, there was a sect in Asia Minor, the Paulicians, following a leader named Paul of Samosata who rejected many of the orthodox teachings of the Roman Church. They were in many ways forerunners of the Unitarians of today. They were persecuted by the orthodox, and many settled in Bulgaria. It is stated that about 850 the Empress Theodora killed 100,000 Paulicians. Later adherents were called Bogomils, who, however, adopted certain accessory beliefs such as the conflict between Michael and Satan—who in their creed are both sons of God. The Bosnians adopted this faith, which resulted in crusades against them by Hungarians, Croats, and Serbs. When the Turks finally conquered this part of the world at the battle of Kossovo in 1389, the Bogomil aristocrats of Bosnia largely accepted the Moslem

faith, which enabled them to keep on good terms with the powerful Turkish enemies of the Croats, Serbs, and Hungarians. Many of the Bosnians rose to high office in the Turkish Empire. Today there are about one and a half million Moslems in Yugo-Slavia, with their chief centre at Serajevo (Fig. 44). In the adjacent state of Albania there are about 700,000 folk who profess this faith, and Moslems also inhabit the Yugo-Slav territory around Prizrend and Skoplye.

THE PROTESTANT SCHISM OF THE SIXTEENTH CENTURY

In spite of its noble purpose it is at least arguable that Christianity in its present imperfect form has produced more disunion than union among the peoples of Europe, though tribal, national, and economic factors complicated the issues then as now. History indicates rather clearly that through all the centuries since the time of Christ the so-called Christians have fought more vigorously in support of rather controversial and relatively unimportant aspects of Christianity than they have ever done to advance the simple self-evident truths of the Great Teacher. Probably the most disastrous wars (before the recent orgy of destruction) were the religious wars in central Europe during the sixteenth and seventeenth centuries—at the outset fought ostensibly to decide which was the true fashion in which to worship the Prince of Peace!

In an earlier chapter it was indicated that religion played a part only second to language in determining national distinctions and antagonisms. Hence it will be time well spent to discuss briefly the role played by the religious factor in the evolution of the nations of today. The religions of note in Europe are the Roman Catholic, the Greek Orthodox, the Protestant, and the Jewish. As we have seen the Moslem religion made no impression on European nations except in the Balkans, where the districts in Bosnia and Albania following this creed (Fig. 44) are shown dotted and by the initial M.

There are about thirteen million Jews in the world,¹ of whom four million live in Russia, two million (before 1939) in Poland, and about one million in the former territory of Hungary. There is a very definite belt of central Europe where over 15 per cent of the inhabitants are Jews. This is shown by the dotted area on the map in Fig. 44, and extends from the Black Sea near Odessa to the boundary of East

¹Isaiah Bowman, *The New World*, 4th ed., New York, 1928, p. 534.

Prussia. Elsewhere the Jews form a negligible proportion of the national population, except in a few cities like Frankfurt on the Rhine, Amsterdam, and especially New York, where there are said to be nearly two million Jews. It is obvious from the map, that the Jews in Germany and Italy cannot constitute a problem of any importance. In the former country they were much less than 1 per cent, and in Italy there were about forty-seven thousand Jews amid nearly forty-seven million Catholics.

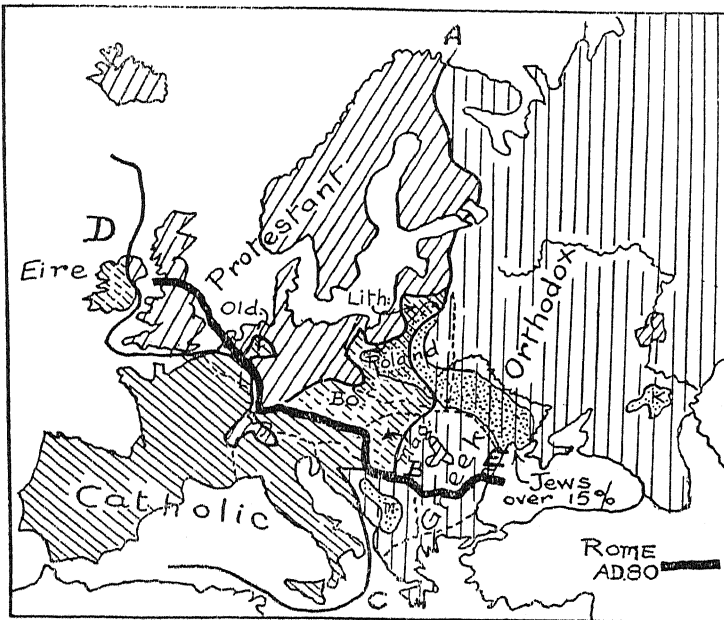


FIGURE 44.—The dominant religions in Europe today. The heavy black line shows the northern boundary of the Roman Empire. The Polish Catholics are far north of this boundary. The dotted area is largely Jewish. M means Moslem; K is Kalmuck.

The Jew is of necessity an internationalist; he is—when educated—fundamentally opposed to the jingoistic, Fascist type of ideology. His shrewdness and industry arouse jealousy among the *petit bourgeoisie*, who often constitute a large proportion of the Fascist following. It is for these reasons that the cult of anti-Semitism is fostered by the Fascists. They know that the intelligent Jew is a strong supporter of their liberal opponents. It is a thousand pities that the German Nazis

after wreaking their spite on the small minority of innocent Jews in their own territory overran precisely that belt in central Europe (in the Ukraine, Poland, and Lithuania) where the Jews are actually a quite important minority, as recorded above. The actual proportions in Poland are worth mentioning: Roman Catholics 65 per cent; Greek Catholics 22 per cent; Jews 10 per cent; and Protestants 2½ per cent.

The breakaway of the Protestants (during the period from 1516 to 1648) was entirely directed against the western or Roman Catholic Church, and had no relation to the Greek Orthodox Church of eastern Europe. Before Luther's revolt, when he published his famous remonstrance at Wittenberg in north Germany, we may assume that the line separating the two religions ran approximately from A to C in Fig. 44. As stated earlier the western portion was converted from Rome and the eastern from Constantinople. The major cultural division in Europe, in the writer's opinion, is the line D to E, which indicates the northern boundary of the region which had experienced the blessings of the *Pax Romana* for more than three centuries. It cuts the line AC in the middle of Yugo-Slavia at B. Just to the west of AC is a Slav group (the Croats) who are strong Roman Catholics. To the east of the line AC are the Serbs, who are ardent followers of the Greek Catholic Church. There have always been quarrels between these two groups—although they speak the same language. Their animosities are very like, and just as foolish as, those separating the English and the Irish!

It would be out of place to attempt to summarize the cause of the wars of religion, which desolated north-west Europe from about 1520 to 1640. But the order in which the nations were drawn into the conflict, and the wide range of the campaigns can be gathered from the diagram given in Fig. 45. Here the large figures 1 to 11 show the main stages of the conflict. We begin with the bold act of Luther at Wittenberg in 1517 (labelled 1). This encouraged the peasant revolt which broke out in the south of Germany in 1524, though Luther himself was opposed to the action of the peasants. A few years later Zwingli and other liberal-minded Swiss revolted against the Catholic authority. Their success played a great part in deciding many of the Swiss cantons to adopt the Reformed religion.

A few years later England (4 in Fig. 45) broke away from the Roman Church, mainly owing to the selfish desires of Henry VIII. It is indeed remarkable that this arrogant and unprincipled monarch should share with Luther, Zwingli and other philosophers some credit

for the Protestant Reformation. The French king, like the Austrian, was a firm supporter of the older religion, and he shocked Europe in 1572 by ordering the massacre of the Huguenots in Paris (5 in Fig. 45). Actually a little earlier, the Dutch burghers revolted against their Spanish rulers, and succeeded in acquiring a considerable measure of independence by 1579.

Bohemia had long been a centre of the Reformation, since there were many who held by the teachings of the reformer Huss, who had

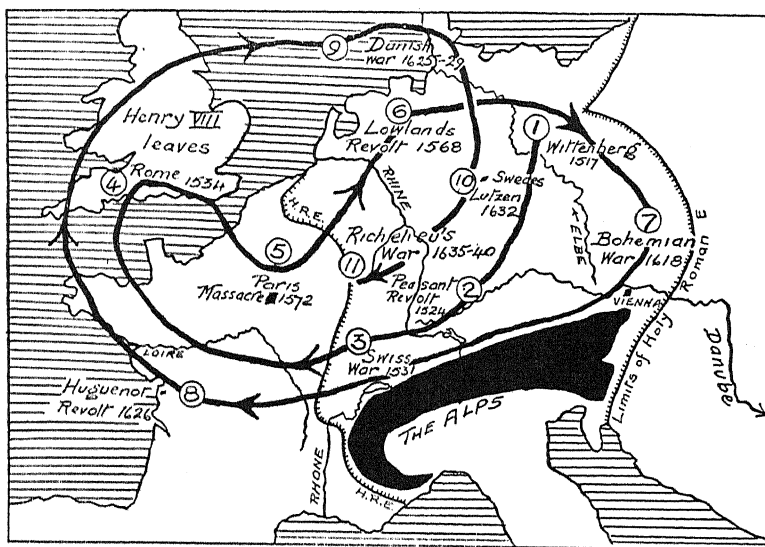


FIGURE 45.—The areas affected by the struggles of the Reformation, shown in eleven stages from 1524 to 1640. The heavy black line shows the way in which the events moved in the north-west of Europe. The boundary of the Austrian (i.e., Holy Roman) Empire about 1500 is shown.

been burnt by the Catholic authorities in 1415. In 1618 the reformers' party revolted against the Catholic authorities (7), but they were decisively defeated at the battle of White Mountain in 1620. Since that date Bohemia on the whole has been markedly Catholic. In France somewhat the same conditions operated in the western districts, where the Protestants had flourished after the Edict of Nantes in 1598. Here were many Huguenot towns, and for a time the reformers held the large port of La Rochelle (8). Here, as in Bohemia, the stern decrees

of the Catholic king, such as the revocation of the Edict of Nantes in 1685, resulted in the dispersion of the reformers, and France has been essentially Catholic since that date.

The northern princes were almost universally in favour of the reformers, and the Danish king (9) came to their aid in 1625. He had little success, but the Swedish king, Gustavus Adolphus (10), was a superb military leader as well as a keen supporter of the Reformed Church. He won many victories against the Catholic emperor, but was killed at Lutzen in 1632. The last phase of this veritable "Hundred Years' War" was due to the rivalry between the French Empire and the Austrian (or Holy Roman) Empire. Both parties were strongly Catholic, and the real ruler of France was the churchman, Cardinal Richelieu. However he came to the aid of the Protestant party, and fought many battles, which resulted in a victory for the opponents of the Austrian emperor. The close of these terrible struggles—almost continuous in central Europe from 1524 to 1645—at the Peace of Westphalia left the German countryside ruined. They set back civilization in this area for many generations, and partly accounted for the very slow development of national unity among the German people.

It will be noticed from the map in Fig. 45 that most of the battles were confined to the German area, and nearly all of them were to the north of the Alps. There were two strong centres of the Catholics, at Paris and at Vienna, but the French Huguenots were always a small minority—say about one-fifteenth of the nation—and were rather readily overcome. Hence though the Reformed religion practically died out in France, the nation was not devastated to the same extent as the German culture-groups, where the two parties were much more equal in numbers and power.

We may now return to the map given in Fig. 44, where the area which finally became Protestant is clearly shown. For the most part it lies to the north of the boundary of the Roman Empire, and we may be sure that the phrase "last to join, first to leave" in part explains why these Protestant groups rather readily split from the Roman Catholic Church. They were not so fully saturated with the cultural heritage of Rome (Fig. 34). However, another very interesting correlation may be made, i.e., with the distribution of the Nordic race. It does look as if the robust ideology of these northern peoples did not take altogether easily to a religion which, after all, was based in part on the ideology of the milder southern Mediterranean peoples. Yet there is no simple

answer to the question: Why did some nations accept the Reformed faith, and others hold by the older Roman faith?

Ireland, owing to its isolated and marginal position, was slow to receive new ideas. It held to the old faith—going back to the year 400—even though it never was controlled by Roman arms. England swung over largely owing to the power of the desoptic King Henry VIII, though no doubt the teaching of the Lollards (1382-94) was a factor. Bohemia on the other hand—despite the widespread adherence to the teachings of Huss—ultimately became strongly Catholic, as explained earlier. Poland at first was disposed to adopt the Reformed faith. Indeed the Socinian “heresy,” allied to Unitarianism, flourished in Poland until the Socinians were expelled in 1638. However there was no union among the opponents of the Roman Catholic party, which was vigorously supported by the Jesuit Society. Accordingly our map (Fig. 44) shows a long “tongue” of Catholicism extending as far as Lithuania, where the dominant religion obviously flourished, despite its remoteness from the soil fertilized by the ancient culture of the Roman Empire.

CHAPTER VIII

CULTURAL CHANGES AMONG THE NATIONS OF NORTH-WEST EUROPE¹

THE GENERAL ENVIRONMENT

WE may well conclude our general discussion of the geographical factors affecting European national development with a somewhat more detailed study of those nations with which we are most closely associated. The build of north-west Europe can be grasped without any geological training by reference to Fig. 46. Here the essential features which have determined the environments in England, France, the Lowlands, Germany, and Switzerland, can be readily identified from the following description.

There are four main types of topography indicated in Fig. 46. In the south are the most striking features, i.e., the young mountains, which were produced during the Alpine Storm—mostly during the last half of the Tertiary period, say in the last ten million years. These high rugged fold-ranges are shown by rather sharp peaks in the sketch map. Then there are the “relic stumps” of a preceding period of mountain-building, which occurred about 150 million years ago. These “stumps” appear today as plateaux of various heights. In general they also have participated in the uplift of the Alpine Storm, but they have been lifted *en masse* without folding. This group of old plateau-like structures is often called the *Older mass*. It occurs in Wales and Cornwall (in Britain), and as the low plateau of Brittany in France. There are other examples in France, such as the Cevennes in the south and the Ardennes in the north-east. The long narrow plateaux (called *Horsts*) which surround Bohemia, such as the Sudeten and Ore Mountains, also belong to this series of relic stumps.

Of younger and less elevated formations there are two of considerable importance. The chief structure of the north of France and east of England is the “London-Paris Basin,” which is clearly shown on the map. This oval-shaped area consists of a pile of “saucers,” each repre-

¹It is perhaps worth while to remind the reader that this chapter emphasizes the geographical approach to many vital cultural problems in Europe.

senting a separate geological formation. They are labelled from 4 to 7, and the upper "saucers" are successively smaller than those below. The edges of these saucers are called Cuestas, and they stand out as long scarp-like ridges. Two of these cross England (Fig. 47) and are given local names, such as the Cotswold or Chiltern Hills. The English Channel represents a portion of the Paris Basin which has been submerged under the sea. The chalk of Dover is labelled 5, and extends all through northern France as well as south-east England, as is clear from the map.

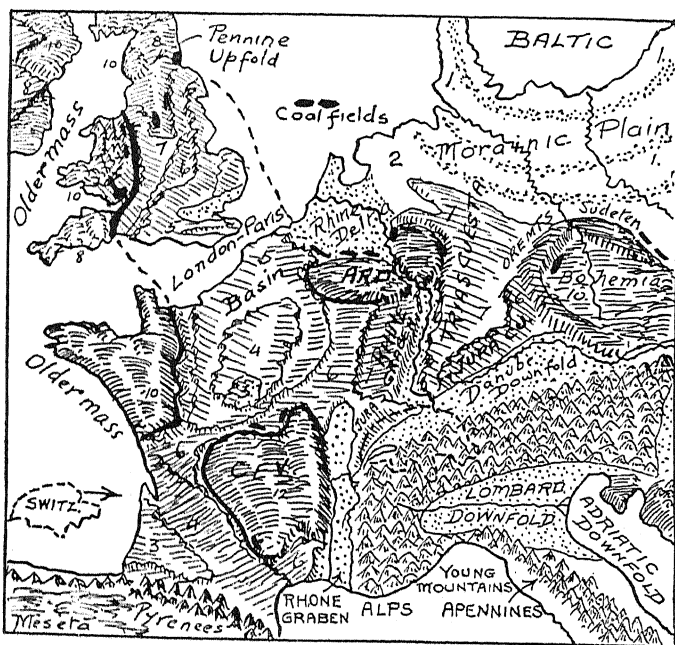


FIGURE 46.—A structural map (mantle-map) of north-west Europe. The younger geological formations 1-7 are laid down above the older formations 8-12.

These rocks of the Paris Basin extend into southern Germany, where they form part of a broad low "Arch," built up chiefly of Jurassic and Triassic formations 6 and 7. This broad arch has been cracked along its summit to form a "Graben," i.e., a down-dropped block of the earth's crust. The middle Rhine naturally occupies this depression, which is labelled the "Rhine Graben." (A somewhat similar arch of

rocks builds the Pennine Range in north England.) Near Nuremburg there is a westward-facing Jurassic Cuesta (labelled 6 in Fig. 49), which originally was continuous with the eastward-facing cuesta 6 in the east of France. There is an isolated basin like that near Paris which centres at Bordeaux. It is worthy of note that the capital of France was transferred from the focus of the Paris Basin to the focus of the Bordeaux Basin during the disaster of 1940. Of course London is similarly situated at the focus of its basin. These examples emphasize the importance of the centres of geological basins in terms of human settlement and government. (The structure of Germany is described in some detail in a later section.)

CULTURE-WAVES IN ENGLAND AND WALES

In Fig. 47 the way in which the various culture-waves in England have been vitally affected by the build (or structure) of the country is clearly brought out. In the central larger map is shown the build of England and Wales on a larger scale. The method of showing the build is a novel one, since the layman can see at a glance that the eastern formations cover (or "mantle") the older formations in the west. This result is obtained by emphasizing the edges of the formations. Those numbered 1 to 5 constitute the "Older mass," those numbered 6 to 10 (in the legend to the large map) comprise the "Younger mass." Such a map is called a mantle-map.

In general the younger formations are naturally the softer, and more quickly vanish under the attacks of rain, rivers, frosts, etc. The mountains in Wales rise to a height of 3,571 feet in Snowdon. This district is built up of the oldest and hardest rocks in England and Wales. Partly for this reason they have resisted erosion, and not worn down as quickly as those of the east. It is worth remembering that any mountain will probably be worn down nearly to sea level in about twenty million years. Hence we can deduce that most of England was raised several thousand feet during the Alpine Storm, i.e., within the last twenty million years. Much of the west has vanished, and all the softer and younger east is worn down nearly to sea level, except the two long ridges or cuestas labelled "Cotswold" and "Chiltern." These consist of limestone or chalk, which resist erosion better than clays or sandstones. Between these elevated cuestas are broad, low Vales made of the softer rocks, and this alternation of cuestas and vales has been of great significance in the development of British culture.

Surrounding the main map (in Fig. 47) are six smaller maps, each representing culture-groups at various periods. Fleure and others have shown that in Neolithic times the primitive population was distributed as shown in the top left map. Clearly it was controlled by the Older mass and the two cuestas, representing the more open uplands of Britain, for Neolithic shepherds could cope neither with the forests nor with the wild beasts of the vales.

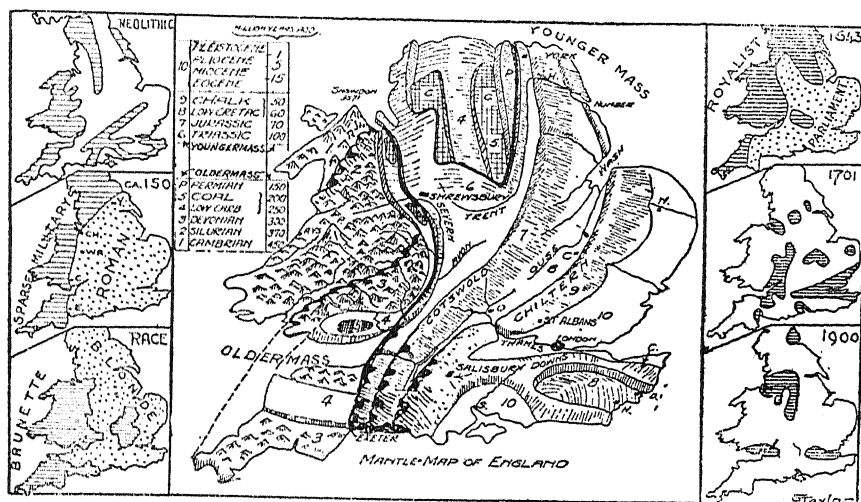


FIGURE 47.—A mantle-map of England and Wales. The effect of the build on the populations at six stages of English history is shown in the six inset maps.

In the second map the distribution is quite different. The Romans controlled the softer, weaker rocks (especially the vales) of the Younger mass, where agriculture was possible, but left the rugged Older mass to the less cultured British tribes. They only maintained scattered garrisons in the north and west, their chief garrison towns being York, Chester, Caerleon (near Cardiff), and Exeter.

In the third map (Fig. 47) the racial strains of today are indicated. The major change in this respect occurred as the result of the Anglo-Saxon invasions of the fifth to the ninth centuries. We see that there is a western group inhabiting the rugged Older mass which is essentially Mediterranean (brunette) in race, while the eastern Younger mass has, essentially Nordic people. The Pennine area, though part of

the Older mass, is not rugged enough to serve as a refuge for the Mediterranean peoples, though they still seem to dominate the Chiltern cuesta and the fenlands north of London.

In Stuart times (1643) the cleavage between Royalists and Parliamentarians was based indirectly on the build. Thus the Older mass was wholly Royalist, while the Younger mass was wholly for the Parliament, except for the region around Oxford. Here again the marginal rugged country seems to have been a stronghold of conservative ideas, while London and the more progressive south-east supported the Puritan party.

The distribution shown for 1701 (based on Muir, Philip, and McElroy) indicates the control on settlement during the agricultural zenith in England. The densest population was confined to the vales, where the richest soils occurred. Here also were the remains of the forests which (before the general use of coal) were of great importance in such industries as iron smelting. By 1900, however, the Industrial Revolution had been in control for nearly a century, with the result that the coal supply (5 in Fig. 47) was the chief factor in determining the dense populations, except as regards London. The most valued coalfields in Europe occur in the Carboniferous formations. These lie at the top of the Older mass, and therefore immediately under the lowest beds of the Younger mass. Accordingly we find that the coal populations of today in Europe are largely found just along the line which separates the Older mass from the Younger mass. This is true in Britain—where the beds labelled 5 can be traced in such a position. In France, if we turn to Fig. 46, we can see why the Lille coalfield should be just to the west of the Ardennes, and why the Le Creusot factories should be sited just at the north end of the Cevennes Older mass. So also in Germany we shall find much the same situation for the rich “black” coalfields (Fig. 49).

THE EVOLUTION OF HOLLAND AND BELGIUM

Few studies of the development of nationality are more interesting than those concerned with the two nations of the Lowlands. As usual it will be well to understand the environment before considering the human aspects of the problem. In Fig. 48 a simple map of the structure is drawn, which gives in detail the features shown also in Fig. 46 on a smaller scale. The Older mass of the Ardennes, with its twin “mass” across the Rhine, has risen about 2,000 feet during the Alpine Storm.

The Rhine has cut its way across this rising barrier, and produced the beautiful Rhine gorge, of the type called "juvenile" by the geographer. The vast masses of silt, sand, and gravel brought down to the sea by the Rhine, and by the adjacent Meuse and Scheldt, have in part overloaded the crust, and led to the marked subsidence of the Lowland coasts.

Lying on the Older mass, and forming the upper beds of the same are some of the most valuable coalfields in Europe. We see the Liege-

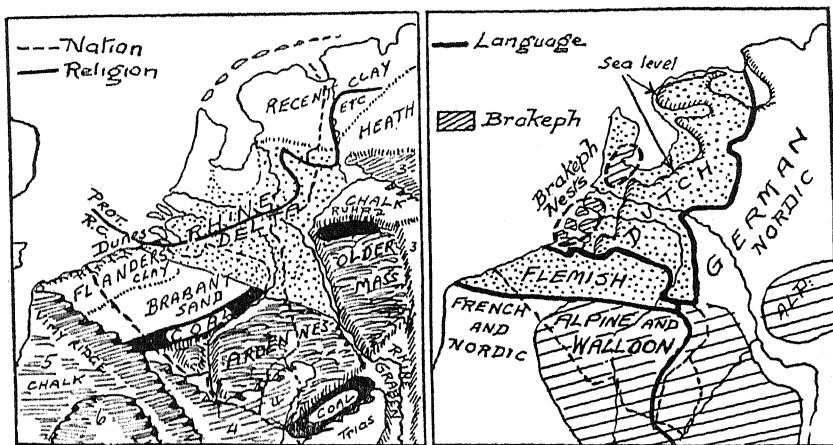


FIGURE 48.—The evolution of Holland and Belgium. On the left is a structure map also showing the religious divisions. The right-hand map shows the racial and linguistic divisions.

Lille field to the west of the Ardennes, where the coal seems to occupy something of a *graben*. Along this depression flow the Sambre and the Meuse. The other coalfields of the Saar and the Ruhr have similar positions in Germany. Holland consists almost wholly of the very new formations of delta material, but Belgium contains older beds akin to those found in the east of England. Lying on top of the coal, which is worked by pits in places, we have the sandy formations of Brabant, which are not much above sea level. Overlying these beds (which dip to the sea) are the still younger clays, which produced the ill-famed mud of Flanders. On the western edge of this latter formation are high coastal Dunes, which are a marked feature near Ostend and Dunkirk. They are partially drowned in the north, where they form the Frisian Islands.

In Holland a belt of varying extent, but perhaps thirty miles wide on the average, has been slowly reclaimed from the sea as the shores gradually sank. Near Walcheren it is stated that a Roman temple is now thirty feet below the sea. Great storms in the thirteenth century tore away much of the coast, and led to the formation of the Zuider Zee (South Sea). By means of dykes 20 feet high and 200 feet wide the sea has been kept out of these drained lowlands, which are called *Polders*. The reclaimed land to the west of the old shore is indicated in Fig. 48.

There seems little doubt that in pre-Roman times much of this country was inhabited by rather broad headed Alpines following the culture of the Keltae. They were gradually driven out of Holland by the advance of the Teutonic tribes, such as the Frisians and Franks, who then occupied the delta lands of the Rhine. However, there are still "nests" of very "brakeph" folk in the lowest polders of Holland (Fig. 48, right), and it is possible that they are descendants of the early Alpines, though they speak Dutch today.

Thus the people of Holland are fairly homogeneous, since they are all (except the Alpine "nests") of Nordic race and speak Dutch, or the allied Frisian in the far north. This latter dialect is said to be nearer English than any other Teutonic speech, which is natural, since these Frisians are close kin to the Saxons who invaded England in the sixth century. With respect to religion, about one third of the Dutch are Catholics, but these are very solidly distributed in the south-east of the country in Limburg and north Brabant, which are the latest additions to Dutch territory.

In Belgium, however, we find a great diversity of cultural and racial groupings. The rather sterile slate plateau of the Ardennes is still inhabited by folk of Alpine race (Fig. 48, left). They apparently were not much affected by the wave of Franks who poured into Flanders and into France. They naturally speak the French tongue of the civilized Keltae, who for so long were under the aegis of the *Pax Romana*. Folk of this culture-group are often called the Walloons. In the lower lands of Flanders, and to some extent in Brabant, the Flemish language is dominant. Hence Flanders is Teutonic in its culture, although it lies on the west side of the great Rhine culture-line. The Flemish folk are directly descended from the Franks, and are Nordic in race. However, here again they are somewhat out of line with usual correlations, for they are strongly Catholic in religion, as also are the Walloons.

Here in Holland and Belgium we have two nations which seem to contradict the usual arguments for national unity elsewhere. Why are they separated, when each is only the size of a single province of, say, France or Germany? Would it not be better to unite into one nation for defence and for economic reasons? After Belgium revolted against the Austrian Hapsburgs in 1795, such a union was tried for a period of sixteen years, but it did not work well then, though the need for union may be more obvious today.

We have seen earlier that the Lowlands were very important portions of the realm of Charles of Burgundy, who died in 1477 at the battle of Nancy. Through the marriage of his daughter, Mary, most of these lands were joined to the Hapsburg dominions, though the huge territories of the bishopric of Liege remained outside the Hapsburg control. In 1521 the Netherlands passed to Spanish control. As the result of the Dutch wars of independence already described, the boundary between the United Netherlands (which broke away from the Catholic Empire) and the Catholic Netherlands in 1609 followed close to the west-east portion of the Maas. Most of the region to the south in Brabant and Limburg was Catholic, but in the recurring struggles between Holland, France, Spain, and Austria, the boundary was much modified, and usually in favour of Holland. The Catholic Netherlands (i.e., Belgium) were acquired by the Spanish Bourbons about 1700, and then handed over to the Austrian Hapsburgs in 1713. A revolution in 1795 led to temporary union with Holland as stated earlier, but the latter country treated the Belgians rather autocratically, so that they broke away in 1831. Much of Limburg (in the north-east of Belgium) was given to Holland on this occasion. Hence the final boundary shown in Fig. 48 has resulted from a variety of motives, and agrees neither with racial nor religious limits. We may perhaps summarize our conclusions in a generalized table as follows:

COMPONENTS OF DUTCH AND BELGIAN CULTURE

Region	Race	Language	Religion	Industries
North and central Holland	Nordic	Dutch	Protestant	Colonial trade
South-east Holland	Nordic	Dutch	Catholic	Rhine trade Agriculture
Northern Belgium	Nordic	Flemish	Catholic	Agriculture
Southern Belgium	Alpine	French	Catholic	Coal and factories

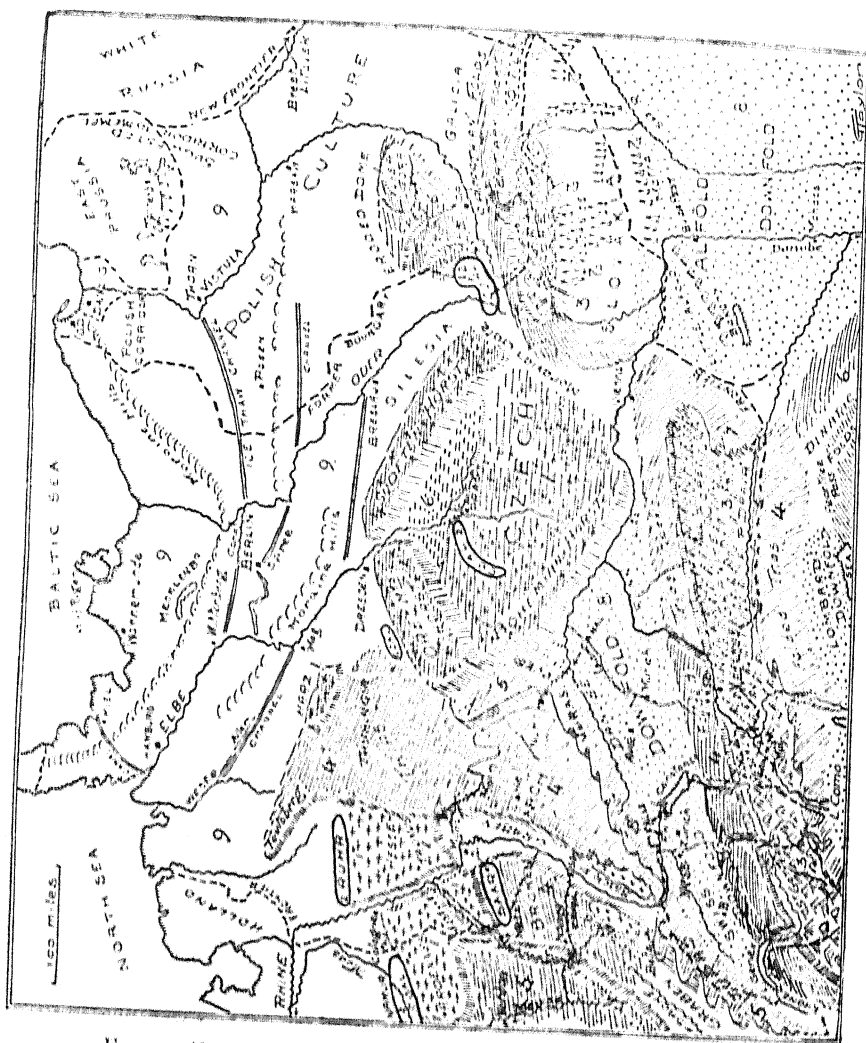


FIGURE 49.—The build of Germany and central Europe, shown by a mantle-map. The older formations have the smaller numbers. The old relic blocks are labelled 1; the coalfields are 2; the cores of the young mountains are 3; their flanks are 4; the cuestas are 4 and 5; Cretaceous rocks are 6; volcanic rocks 7; silts filling the downfold are 8; and the plains, covered with glacial debris, are labelled 9.

We must come to the sensible and satisfying conclusion, which will be emphasized when we study the evolution of the Swiss Republic, that "time and goodwill" are more important ingredients for making a contented and prosperous nation than race, language, or religion!

THE EVOLUTION OF THE GERMAN NATION: THE ENVIRONMENT

As the result of the various aggressions in recent years Germany controls a solid block of German-speakers, as well as many other alien peoples in central Europe (see Fig. 50). In the large chart (appearing as Fig. 49) the structure of central Europe is shown in the form of a mantle-map. At first glance the Reich is seen to consist of two nearly equal parts, a northern plain and the hilly and mountainous country to the south. But the latter large region must be divided into four further areas, which are readily distinguished in the mantle-map (Fig. 49) owing to the differences in their build.

From the point of view of structure, the most stable portions of the Reich are situated near the central line running from west to east. They comprise the relic stumps already mentioned. These represent the mighty range of mountains of Permian times, about 150 million years ago. After that date they were worn down to undulating rocky plains (*penepains*) near sea level. As a result of the Alpine Storm they have been re-elevated *en masse* to varying heights. These relics are labelled 1 in the mantle-map (Fig. 49). The Ardennes, Taunus, Vosges, and Black Forest, are relics near the Rhine. The Harz, Ore and Sudeten Mountains are near the Elbe; while Lysa Gora is a similar relic in Poland.

The coal of Germany consists of both the "black" and the "brown" varieties. The former is the more valuable, and its situation just at the top of the relic stumps has been explained before. Thus we find the Ruhr and the Saar on the flanks of the Ardennes, the Saxon and Bohemian coalfields on each side of the Ore Mountains, and the famous Silesian coal just to the east of the Sudetens. The brown coal is widely spread among the younger formations, especially to the east of the Harz Horst.²

We may now consider the younger elements of the build. The major crustal folds in central Europe have produced the Alps, which appear at the foot of Fig. 49. The complicated folds are somewhat

²A horst is an up-thrust block of the earth's crust.

simplified in the map, which shows the hard "core" of granites and allied rocks, with the flanks made up largely of Triassic sediments. The latter possibly covered most of the whole Alpine area at first, but the higher central portions of the ridges have been removed by the great erosion, which naturally affects the steepest slopes first.

The main rivers of the Alpine region are seen to be of two kinds. Some flow parallel to the general axis of the Alps, and these are "longitudinal" rivers: such as the upper Rhine, and upper Rhone, and upper Inn. Others flow straight across the formations directly to the foot of the Alps, such as the middle Rhone and the middle Rhine in Switzerland (see also Fig. 82). These are "transverse" rivers, and usually occupy much narrower gorges than do the longitudinal. The structure of the Carpathians (which are sketched on the right of Fig. 49) much resembles that of the Alps, though there are more volcanic rocks on the southern side of the Carpathians.

In addition to the folding of the crust upward, there was also pronounced folding downward in several regions. Among these are the Lombard plain in Italy, the Danube downfold north of the Alps, and the Hungarian "Alfold," now occupied by the middle Danube. These areas are shown dotted in the mantle map. The downfolds have naturally been largely filled with debris torn from the nearby mountains. In places the filling is not levelled off, and here large lakes occur, like Lakes Geneva and Constance, and many others near Munich which are not charted.

The last section of the hilly division consists of the gentler folds to the north-west of the Alps. A broad simple arch was formed between the Alps and the resistant block of the Ardennes. As explained earlier, sometime after the folding the centre of the arch collapsed, forming the Rhine graben south of Mainz (Fig. 49). This is about twenty miles wide, and has always been a very important obstacle in the path of armies wishing to attack along west-east routes. There are two very important military corridors on each side of the Sudeten Horst (uplifted block). The Elbe occupies one such gap just south of Dresden, while the Oder rises near the famous "Moravian Gate" between the Sudeten and the Carpathians. So also the Danube has occupied the depression between the Bohemian Horst and the Alps, and flows through a much restricted plain at Vienna. This gives to this city one of the chief military positions in Europe.

The great plains in the north of the Reich have not been affected

by the Alpine Storm, probably because they are buttressed far below the surface by an extension of the unyielding Russian shield. But their surface—as mentioned earlier—has been greatly modified by the ice ages of the last million years. In Fig. 49 the crescentic moraine-ridges are fairly well shown, one of the most pronounced helping to form the long peninsula of Denmark. Innumerable lakes lie between these hills, and some of the most extensive occur in East Prussia, where they are known as the Mazurian Lakes. Others are very abundant in the vicinity of Berlin.

Another very characteristic feature of these plains is the “ice thaw channel.” When the great ice cap covered part of the plains, a thaw-river naturally developed along the slowly retreating ice front. This cut out a broad shallow valley, and these valleys are still quite obvious. The rivers of today occupy them in part, such as the Elbe below Wittenberg or above Magdeburg. It has been relatively easy to dig canals along these channels linking the main rivers; and one such is shown on the map near Berlin, connecting the Oder and the Elbe. There are other canals, as at Thorn, linking the German and Polish rivers by east-west channels. A canal of some interest links Nuremberg to the Danube, and so enables barges to cross Europe. One can travel from the English Channel via the French canals to the Rhine and Main, and so down the Danube to the Black Sea. This latter series of canals has, however, no connection with thaw-water channels.

CULTURAL CHANGES IN THE GERMAN NATION

Long before the Roman republic was of any importance the Teutons burst down from Denmark and drove a wedge between the Keltae on the west, and the Slavs on the east. The early prehistory of the Germans is concerned with the displacement of the Keltae into the Rhinelands, and later with the driving of the Slavs from the region of the Elbe and the Oder. We have usually assumed that these early Germans were essentially Nordic in their racial composition. This may be true, but C. S. Coon³ points out that the dominant type in north-west Germany today is not Nordic at all! He claims that the commonest stock is what he calls the *Borreby* race (Fig. 50, right). These are big-headed, rather heavy-featured persons belonging to the Paleolithic

³Carleton Stevens Coon, *The Races of Europe*, New York, 1939.

hunting tribes, who in his opinion still contain an appreciable amount of Neandertal blood.⁴

Coon hazards the opinion that the active quarrelsome Nordics largely killed each other off, during the 120 years of war (1524-1644) which marked the rise of the Reformation. These Borreby stocks are most marked around Kiel and the island of Fehmarn, but their distribution is shown by the heavy broken line in Fig. 50. The Nordics seem to have migrated south along the Rhine graben, and perhaps

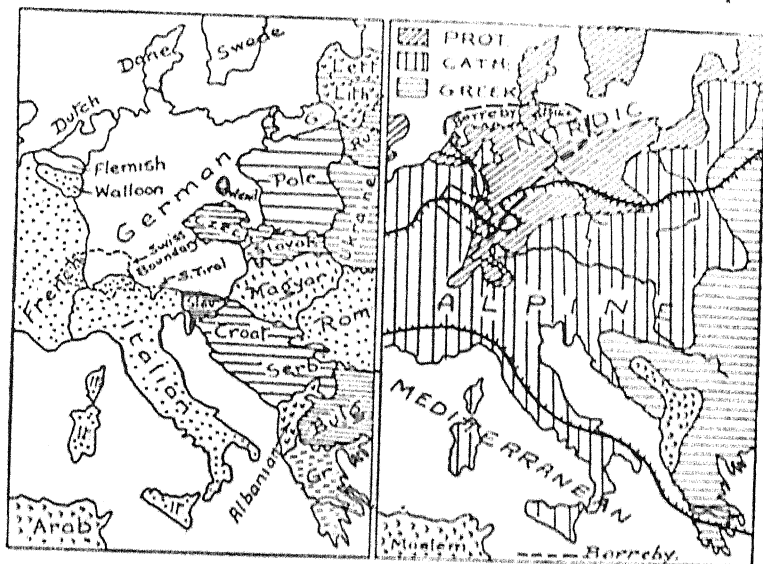


FIGURE 50.—The linguistic divisions in central Europe which best express real cultural groups. (Notice however Switzerland.) The Slav languages are shown by horizontal ruling, and the Romance languages by dots. On the right, the religions and races are correlated. The Borreby race (of big-headed, Paleolithic survivors) is based on Coon.

reached Bern and Vienna in notable numbers. But all this mountain area was the home of the Alpine race, and we do not know when the Teutonic culture was adopted by these, at first, alien stocks. (Indeed it has been suggested that the Nordics acquired their language from the Alpines, but at present this is little but speculation.)

The Franks, as we have learnt, gradually built up a strong empire under Charlemagne. His grandson, Ludwig, acquired the vast territory

⁴See my discussion in "Races of the World" (*Human Biology*, Sept., 1941, pp. 390-7).

shown in Fig. 51 between the heavy broken lines. This marked the beginning of the Holy Roman Empire (about 843) in which a union of Germany and Italy—a sort of forerunner of the recent “Axis”—endured for about four centuries.

Such an association is rather rare in history, for there was very little to hold the two groups together, and almost every inducement for them to separate. Racially, northern Germany was largely Nordic while southern Italy was Mediterranean (see Fig. 50). It is true that the mountain and hilly countries were mostly Alpine in race, but by this time the two fairer northern races had lost all idea of their separate origins. The Romans did not differentiate between them, and later gave the title of “Roman citizen” to all dwellers in the Empire, whether they were dark or fair, or possessed broad heads like the Alpines, or narrow heads like the Nordics and Mediterraneans.

The Alps form a great barrier 150 miles wide, and the main divide is everywhere over 6,000 feet, except at two points, the Brenner and Reschen Passes (Fig. 82). To the north of the divide during the Middle Ages almost all the folk spoke German languages (except in Burgundy, which used French), while to the south they spoke Italian. From the political point of view, the country to the north was controlled by various German counts, margraves, and knights; so that ultimately there were no less than 1,800 fairly independent rulers, rather feebly held together by the common German culture, and by their inclusion in the Holy Roman Empire. To the south, a complex system of city-states was evolving, which differed a great deal in organization from that employed in the German region.

The emperors were elected, though the succession usually remained in one family for a time. It was, however, almost always a German who was chosen as Emperor. The Emperor usually disagreed with the Pope, and not seldom was engaged in warfare with him. Indeed it has been remarked that at first the Holy Roman Empire was an “Unholy Collection of Rival German Electorates,” and later became a “Private Perquisite for the Promotion of Hapsburg Policies.” Here was no place for the Italian!

Let us now see how this Empire gradually broke up into separate nations and cultural units. Perhaps its palmiest days were those around 1032, when Burgundy had just been incorporated in the Empire. This period was soon after the time of Otto the Great (912-73) who controlled the *First Reich*. (William II ruled the *Second Reich* from

1888 to 1918.) There were three cultural groups: the German, the Italian, and the French in Burgundy. The rising power in France gradually became the chief rival of the Holy Roman Empire, and it was this factor which kept the idea of a "Teutonic Empire" alive, long after its last units had passed into Austrian (Hapsburg) hands. Indeed Provence and Dauphiné were acquired by France as early as the middle of the fourteenth century.

Meanwhile quarrels between the Emperor on the one hand and the Pope and cities of north Italy on the other led to open warfare. At Legnano (near Milan) the Emperor was decisively beaten in 1176; and although Germany and Italy held loosely together under Frederic II, the inevitable break came in 1273. Rudolf of Hapsburg was elected Emperor on the condition that he relinquish any control of the lands south of the Alps. The next country to rebel was Switzerland, which defeated the Emperor's armies in several battles around 1400. By the end of the fifteenth century the Swiss union of various German and Burgundian cantons had become practically independent of the Empire.

During the struggles of the Reformation the Protestant faith spread rapidly in the regions east of the Rhine-Danube line, for reasons given earlier in this account. After 1437 the head of the Austrian Hapsburgs became Emperor, and the title remained with them almost continuously until 1806. Since the Hapsburgs were always strongly Catholic, they opposed the Reformation with all their power. As we have seen, the northern Protestant princes invoked the aid of Catholic France to defeat the Catholic Hapsburgs. About the same time Holland revolted, so that by the end of the sixteenth century only three of the original territories of the Empire survived. These were Austria, the first acquisition of the Hapsburgs, Bohemia (1526), and much of Lorraine. The latter region also included the early religious centres of Cologne, Treves, and Mainz, which have always been staunchly Catholic. Gradually France reached out to the Rhine, while Austria expanded to the east into Hungary and the Balkans (Fig. 51); but the next episode in German history deals with the rise of the Hohenzollern dynasty.

THE RISE OF THE HOHENZOLLERNS IN PRUSSIA

The ancient castle of the Hohenzollerns is still to be seen on the Jurassic Cuesta near the head of the Danube (Fig. 49). Scions of this

family spread through central Europe, and in 1415 one of them obtained the Mark of Brandenburg. His territory about 1440 is shown black in Fig. 51. Brandenburg is a rather barren portion of the great northern plain in the vicinity of the old Slav settlement of Berlin, and this district became the nucleus of Prussian power. In 1618 the lands

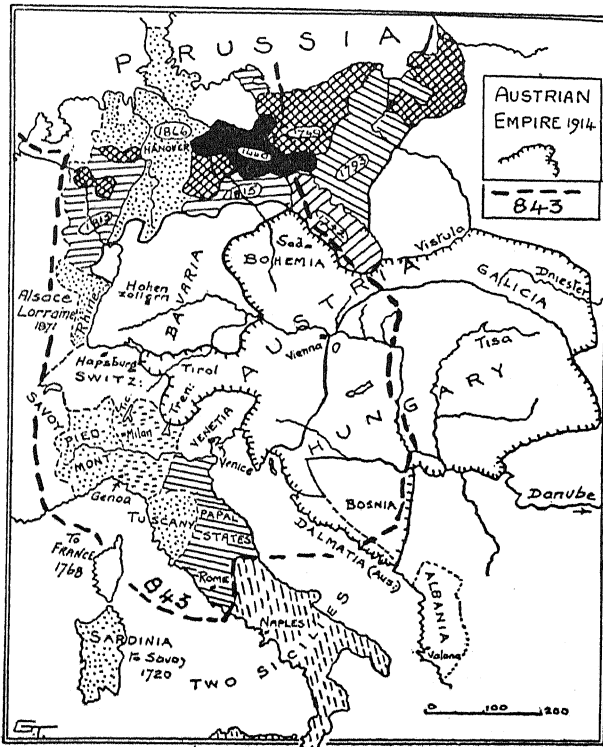


FIGURE 51.—The central powers during the eighteenth and nineteenth centuries. The growth of Prussia is shown in the north, and the evolution of the Austrian Empire in the south. The heavy broken line shows the Holy Roman Empire about 843.

of the religious order of the Military Knights in East Prussia were added to Brandenburg, and somewhat later the name of Prussia was given to all these northern lands of the Hohenzollerns.

As the result of disputes with Sweden and Austria, Pomerania and Silesia were acquired by 1742. Prussia now straggled right across the

German plain, for she had also owned some lands near Holland from an early date. It was the aim of the later Hohenzollerns to unite the whole plain under their control. The partitions of Poland (1772-95) resulted in great gains in the east; but after Waterloo (1815) some of the eastern Polish lands were exchanged for the much more valuable German areas near the Rhine (Fig. 51).

Only Hanover was now needed to complete the Hohenzollern "bloc." Meanwhile the other German states, including Austria, were becoming very jealous of the growing power of Prussia. In 1866 Austria for the second time challenged northern Germany, somewhat as she had done in the wars of religion in the seventeenth century. Prussia was, however, joined by the armies of northern Italy, whose people had been under the heel of Austria for many bitter years. The map in Fig. 51 shows the rival forces in this last armed conflict for leadership of the German peoples.

On the one side were Austria, Bavaria, and Hanover, helped by the smaller Catholic states; while on the other side were Prussia and Italy. In the south the Austrians defeated the Italians, but in the north the genius of Bismarck and Moltke was too much for the Austrians, and they were completely defeated at Sadowa in the north of Bohemia. As a result Hanover and Hesse were ceded to Prussia, while Venetia was restored to the Italians by Austria.

It remains to say a word about the Franco-Prussian War of 1870 in which Napoleon III was decisively defeated by Prussia. The southern German states in this war gave valuable aid to their late Prussian enemies in the invasion of France. The German-speaking province of Alsace together with the rich coal and iron mines of Lorraine, were handed over to Prussia at the end of the war. Perhaps of greater significance was the union in 1870 of all the German states (except Austria) into the German Empire, with the king of Prussia as emperor. Thus in Germany it took longer than in any other country (except Italy) to form a united nation.

The Great War of 1914-18 resulted in the return of Alsace and Lorraine to the French, while the aggressions of Hitler in 1938 brought Austria and the Sudeten Germans into the Reich. These were the last remaining areas of separate German culture, except for sections of Switzerland and also such relatively small groups as those in the Trentino (Fig. 50).

ENVIRONMENT AND NATION IN SWITZERLAND

Switzerland offers the strongest contrast in environment to the Lowland countries, for here we find a nation founded upon the rugged ranges of the Alps. It is even smaller than the Lowlands, and even more mixed in its national ingredients as regards language, about equally mixed in religion, though rather less so in race. It is predominantly Protestant, but has a large minority of Catholics, as it lies on the boundary of the Catholic bloc.

To the writer it is on the whole the most interesting country in the world, although it is only about 200 miles long in an east-west direction, and only 100 miles from north to south. But the variety of landscape and the striking illustrations of human progress packed into this small area are remarkable. Naturally it offers the best example of topographic control in Europe, since it contains the boldest mountains, which are flanked by the Danube downfold. Since, moreover, the Alps lie close to that boundary where Keltic and Teutonic tribes struggled with Rome, where France fought Italy, and both fought Austria and Germany, the region has been in the limelight of history almost all the time from the foundation of Rome to the present day.

The main topographic features are given near the middle of the mantle-map of central Europe (Fig. 46). These are repeated in greater detail in Fig. 52 at A, and the human correlations are given alongside. In this map there are five main topographic belts, which we must have in mind in considering the cultural evolution. Along the north-west border run the rather simple, and not very high, folds of the Jura Mountains, whose highest point is 4,500 feet. To the east of the Juras is the Swiss downfold, sometimes rather badly termed the "Swiss Plateau." This is relatively broad and flat, and lies at an elevation of about 1,500 feet. To the east of the downfold—which continues into southern Germany—are the complex folds of the Swiss Alps. These comprise about one-quarter of the whole Alps, but the highest point (Mont Blanc, 15,780 feet) lies about twelve miles south-west of the Swiss border.

A very marked longitudinal valley separates the Oberland Alps from the remainder. This valley is a fold-valley, much deepened by glacial erosion. It contains the upper waters of the Rhone in the west, and the upper waters of the Rhine in the east. Their common divide is close to the Saint Gotthard Pass, where also head the Reuss flowing

to the north and the Ticino flowing to the south. No wonder that the key to the military situation in Switzerland is this cross-roads area at the Saint Gotthard Pass. It forms the shortest, though by no means the lowest, pass over the wide belt of the Alps, and has been an important corridor of human migration right through history.

The main divide of the Alps runs to the south of this longitudinal valley of the upper Rhone. It includes many high peaks, such as

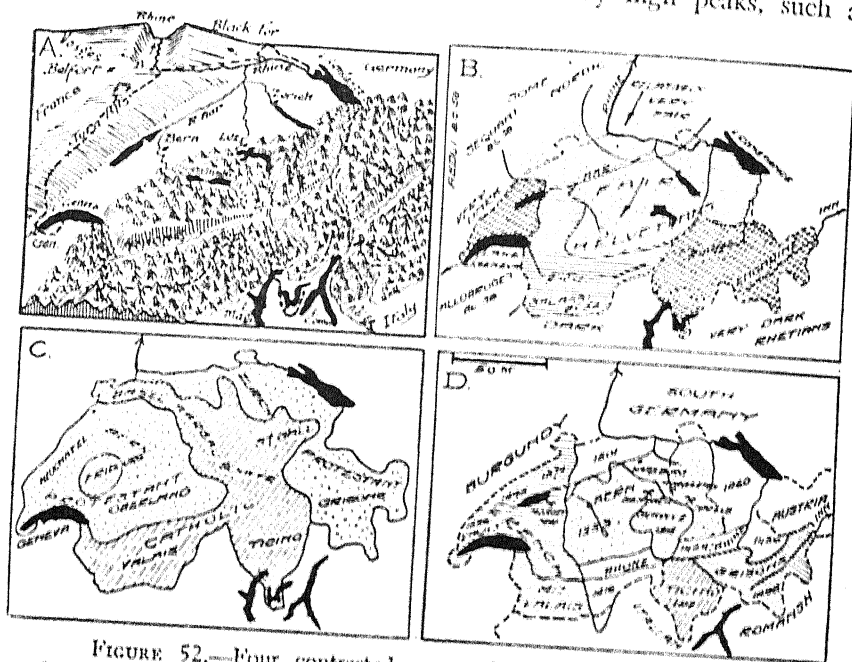


FIGURE 52.—Four contrasted maps of Switzerland. At A is the build, at B the racial units, at C the religious, and at D the language groups. Some historical data also appear at D.

Monte Rosa and the Matterhorn. For a space, it forms the boundary of Switzerland, but there are two mountain districts which lie to the south of the main divide. These comprise the Ticino canton, which reaches to the Lombard plain near Lake Maggiore, and the Engadine or Grisons district, which includes the longitudinal valley of the upper Inn. This latter river rises near the head of Lake Como, but flows right across the main bulk of the Alps to enter the Danube far to the north-east near the Czech boundary. The north-east boundary of Switzerland runs along the River Rhine or along Lake Constance.

They are very important features of the Swiss topography, for only the breadth of the Rhine or Lake Constance protects the lower lands of Switzerland from the similar plains of south Germany (Fig. 52 at A). To sum up, therefore, we find only one-quarter or less of the state is lowland; about the same area consists of the low ranges of the Juras; and more than half the Republic consists of very high, rugged mountains, where human habitation is confined almost entirely to the over-deepened, flat-floored, glacial valleys of the main rivers.

CULTURAL CHANGES IN SWITZERLAND

Governments, religions, and languages often vary considerably in a few hundred years, but the racial units are much less quickly altered, unless an entirely new migration of folk has entered the region. Let us therefore consider the present racial make-up of Switzerland. The outstanding feature is that the heads of the Swiss are perhaps the broadest of any in the world. The head index of the whole state is about 85, while that of England would be about 78. The Swiss then are essentially Alpine throughout, and possess stocky bodies of moderate height, hair of medium brown and often green or hazel eyes. However, there is some variation in the colour of the hair and eyes, which enables us to divide the state into three parts (see Fig. 52 at B). In the mountains, to the west and south-east, are very dark Alpine people, who are sometimes referred to as the *Rhetians*, since some speak the queer Rhetian or Romansh language, of which more later. Then in the main bulk of the mountain area in the south, especially in the Rhone valley, live moderately dark folk; while the northern central portion, especially near Basel, contains people who are distinctly fairer, and have rather narrower heads. The arrangement of the isopleths in Fig. 52 at B, seems to suggest two migrations at least, moving up the Rhine valley and driving the older settlers to the south. Let us now see if historic data enable us to interpret these distributions.

Many lake-dwellings have been found in Switzerland, going back to the early days of the Iron and Bronze Ages of culture. The builders were probably Alpine in race, and we may perhaps assign the Rhetian migration in part to this culture. In the very early days of history the Keltae were dispossessed of their German lands by the Teutons, and moved to the south and west. They seem to have reached Switzerland about the third century B.C. Probably the bulk of these folk spoke

"P" Aryan, and formed the larger part of the northern migration mentioned above. Many of the place-names of Switzerland are Welsh, such as *Nant* ("valley") found near Mont Blanc, and *Penlucius* (on Lake Geneva), which means "head of the lake" in Welsh. Burgundians moved into Switzerland about A.D. 450. Many Alamanni from south Germany had driven the Keltæ south about A.D. 265. They practically

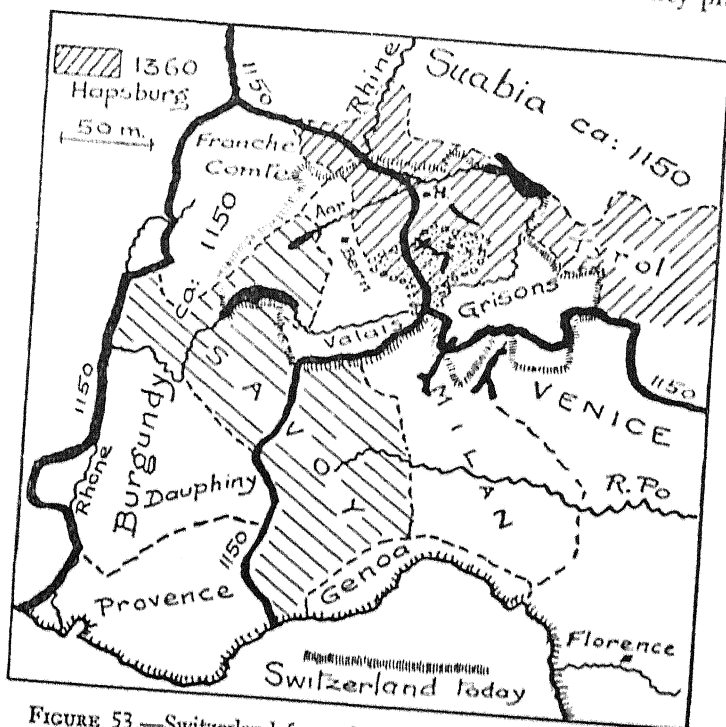


FIGURE 53.—Switzerland from the twelfth to the fourteenth century. The heavy line shows how the whole region was divided between Burgundy and Suabia about 1150. The lighter broken boundaries show the main territories about 1360. The centre of revolt is shown dotted. H is Hapsburg Castle.

destroyed the Roman civilization, and did not become Christians until A.D. 600. Probably mixtures of the Helvetians and Alamanni account for the last migration of rather fair folk shown on the map (Fig. 52).

The early history of Switzerland is somewhat complicated, but will readily be understood if reference be made to Fig. 53. Here the heavy black lines show the chief cultural divisions about 1150, when

Frederic Barbarossa was head of the Empire. The present area of Switzerland is seen to be divided more or less equally between the French culture-area controlled by *Burgundy*, and the German culture-area controlled by *Suabia*. Both were fiefs of the Holy Roman Empire, Burgundy having only recently joined the Empire. As explained earlier, the Italian sections of the Empire broke away in the thirteenth century; and the state of affairs about 1360 in this part of Europe is charted in Fig. 53. North Italy was divided into various independent realms such as Savoy, Genoa, Milan, and Venice. Of these, as shown, Savoy controlled a large area to the north of Lake Geneva, which today is part of Switzerland.

North of the main divide of the Alps the chief power was in the hands of the Hapsburgs of Austria. Their ancestral castle of Hapsburg was just where the River Aar joins the Rhine, and where the old Roman garrison of Avenches was placed to dominate the Swiss downfold. Today the Hapsburg castle (*H* in Fig. 53) and the reconstructed Roman arena of Avenches (both close to Brugg) are well worth the visitor's attention. Much of the Grisons was the land of the Counts of Toggenburg, while areas around Bern were directly under the Emperor's control.

In 1291 the forest cantons of Uri, Schwyz, and Unterwalden formed a league, primarily for mutual protection against the aggressions of the Hapsburgs. These cantons are shown *dotted* in Fig. 53. In 1315 a large Austrian army marched to attack the town of Schwyz (*Sch.* in Fig. 53), but was defeated by one-tenth the number of Swiss at the battle of Morgarten (Fig. 52 at *D*). The name *Switzerland* seems to have been adopted by the rebels in honour of Schwyz, which was perhaps the leading rebel district. Neighbouring regions joined this league, including Bern in 1353. In 1386 and 1388 two more battles resulted in victories for the Swiss, and they were not seriously attacked again for many years. Indeed the Swiss marched into Italy in 1403; and by 1440 the valley of the Ticino, with a purely Italian culture, was added to the Swiss Confederation.

Charles of Burgundy later attacked the Swiss (who had been at war with Savoy) and was defeated and killed at Nancy in 1477. These victories by the German-speaking cantons greatly enhanced the reputation of the Swiss, and led the *French* districts in the west gradually to join the Confederation, while in 1512 the Italian territory linked to the Ticino was considerably increased. Another isolated region was

the Grisons, where the inhabitants were involved in struggles with the Church; they joined the Confederation in 1498. Two of the latest districts to join were Vaud (near Geneva), and the Jura regions to the north of Lake Neuchâtel. They came in after the wars of the Reformation, around 1531 (Fig. 52). By this time the lands of the Confederation had expanded to include practically all of what is the Switzerland of today, but the districts had a cumbersome type of control which differed greatly in various parts. Complete independence was granted to the Republic in 1648. The present system of cantons owes much to the influence of Napoleon in 1803. The last districts given full status as cantons were the Protestant areas of Geneva, Valais, and Neuchâtel, and this occurred in 1815.

We are now better able to appreciate the pattern of Switzerland as it is today. In Fig. 52 at D, in addition to the main features of the history, the distribution of the four main languages of the Swiss is charted. The most used is German, a special dialect of which constitutes Swiss-German. It is spoken in the lands which originally belonged to the German division of Suabia in the early days of the Empire (Fig. 53). This German area includes the lowland east of Bern, and the Oberland Mountains to the north of the Rhone-Rhine longitudinal valley. French is the main language to the west of Bern, and is clearly an inheritance from the Burgundian culture of the early days (Fig. 53). Italian is almost the sole language spoken in the Ticino region; in the Grisons is used the fourth—Romansh or Ladin. This latter is an early Romance dialect, in some respects nearer to Latin than either Italian or French. The following table shows the numbers of folk belonging to various religions, and the numbers speaking the different languages.

SWISS LANGUAGES AND RELIGIONS
(about the year 1930)

German	2,924,000	Protestants	2,230,000
French	831,000	Catholics	1,666,000
Italian	242,000	Jews	18,000
Romansh	44,000		
Rest	25,000		

Turning now to the distribution of the religious groups, we are faced with one of the most complex patterns in Europe. This pattern, shown in a somewhat simplified form in Fig. 52 at C, agrees with none

of the distributions so far charted. The Protestants are found for the most part in the west and in the east. The Catholics occur down the centre of the country and along the south. Clearly these divisions have no direct relation to the topography, since the lowlands contain both Protestants and Catholics, while the mountains of the Oberland and of the Grisons are Protestant, and those of the main Alps, the Ticino area, and the Forest Cantons are Catholic. Nor do the religious limits agree in the least with those of language, as is the case in most countries. The French-speakers curiously enough are, on the whole, Protestant; while the rather primitive isolated folk of the Grisons, whom we should expect to be Catholic, also belong to the Reformed faith.

The reasons for this distribution are quite complex, and only a few of the salient reasons can be mentioned here. During the critical years of the Reformation the personal influence of certain reformers was of great importance. Thus Zwingli had a strong following in the town of Zürich, while Vadianus also influenced the region of St. Gall towards the Protestant faith. Haller and Farel in the region north of Lake Geneva gained many converts. At a somewhat later date Calvin made Geneva a focus of Puritan ideas, though today this district has become rather Catholic again. In the Grisons the animosity against the bishops was bitter, and the peasants accordingly swung toward the new faith.

Economic conditions affected the problem here as everywhere. It is stated by some writers that the reformers opposed the practice of the Swiss serving as foreign mercenaries. These soldiers came largely from Fribourg and the Forest Cantons, and perhaps their dislike of the reformers helped to keep these districts in the Catholic fold. It will also be noticed that the main corridor of travel across Switzerland, from Basel to Lucerne and so up the Reuss valley to the Saint Gotthard Pass and Ticino, remained solidly in the old faith; perhaps because there was a tendency for many abbeys and church lands to be congregated in this district.

In conclusion may I quote from my book *Environment and Nation* the following passage:

Our greatest interest in the study of Switzerland is surely due to its representing in its diversity a little world in itself. With its two different religions, four commonly spoken [and official] languages, very varied environments, and with no very natural centre, it is amazing that it has developed a vivid Nationality. It has been stated that the love of liberty and the love of mountains are the sole links uniting its many

diverse peoples. Possibly a high level of education, a sense of the futility of war, and a feeling that goodwill is the chief essential to solve most man-made troubles, may also be more characteristic of the Swiss than of many continental nations. Their remarkable progress in education, and in international co-operation would seem to support the hypothesis that what Switzerland has done a United Europe might imitate.⁵

STAGES IN NATIONAL DEVELOPMENT

In concluding this section on the place of the nation in the evolution of our civilization, it will be well to summarize some of the features which mark the rise of nationalism. It has its good as well as its evil aspects, but nowadays we all hope to see national competition replaced by national co-operation. As Arnold J. Toynbee expresses it in his very thoughtful *Nationality and the War*,⁶ "civilized wealth is largely due to international co-operation, and perishes during the vicissitudes of war. Hence progress towards an international civilization is very definitely bound up with prosperity and peace."

Whole books have been written on the stages which are involved in the development of a strong nation; and in this brief study we shall do well to confine our attention to the data which are charted in Fig. 54. Here it is suggested that there is a sort of common development through which most of the European nations have passed. It is natural that progressive nations should have moved farther along this series of stages in nationalism than have the backward nations. The column at the left in Fig. 54 summarizes these stages as follows: 1, Divided tribes; 2, Small separate kingdoms; 3, A period of foreign invasions, followed by 4, Military autocrat (or dictator); 5, Period of revolution, which leads to 6a, Constitutional monarchy or 6b, A republic with an elected president. This in turn will, we hope, lead to a co-operative commonwealth of cultural groups. So far the U.S.S.R. seems to have moved farthest along this path, especially in regard to its numerous minority "nations."

Let us see how England (the United Kingdom) agrees with this generalized scheme suggesting the development of nationalism. In common with most of Europe, England, during the sixth and seventh centuries, was changing from a condition of "divided tribes" to that of "small independent kingdoms." Ignoring occasional control by a strong

⁵Chapter xvi, p. 310.

⁶London, Toronto, 1915.

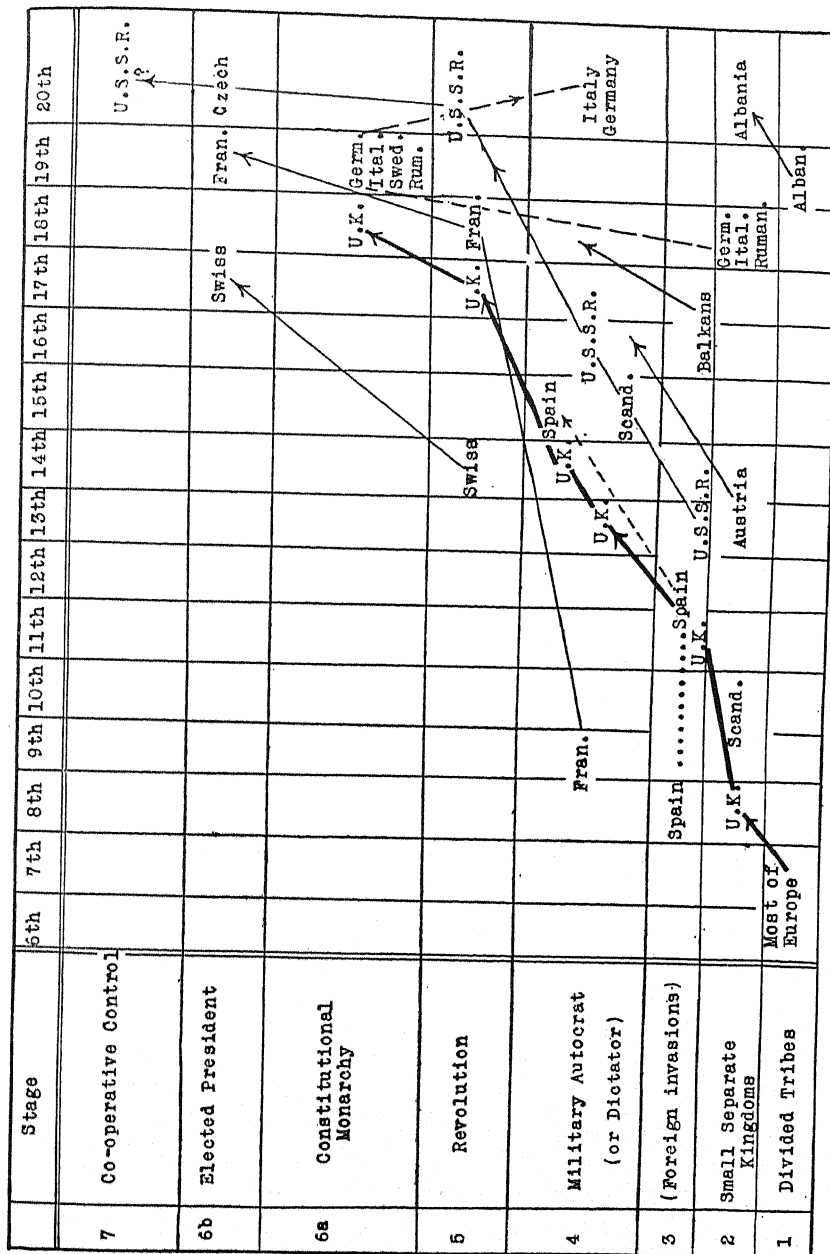


FIGURE 54.—A generalized chart showing seven political changes, through which many of the nations of Europe have passed. Centuries are shown along the top edge.

monarch like Alfred or Canute, we pass through the Danish and Norman invasions to reach the strong military control exercised by the Norman, Plantagenet, and Stuart kings. This was followed by the rebellion and revolution of the seventeenth century, in turn succeeded by the reign of moderately constitutional Hanoverian kings, and the strictly constitutional monarchs of modern times. The heavy black line connects these stages in the chart, and this heavy line shows a typical evolution which has been followed (usually at a later date) by many other countries in Europe.

The Swiss got their revolution over somewhat earlier, and then decided to have a republic. They present one of the most progressive and peaceful evolutions. France's revolution was later than the two just quoted. The general development of the U.S.S.R. lies to the right of the others (Fig. 54), indicating that it followed the usual path, about two centuries later than did England, and about four centuries later than Switzerland. Some readers will object to the advanced position given to the U.S.S.R. in this chart. They will claim that Stalin like Hitler is a dictator; and this view seems correct to the present writer. But Stalin (like Churchill and Roosevelt, when they were in control) is working towards a reasonably socialistic goal. Moreover, it must be admitted that in the times of crisis from which we have just emerged, our admirable leaders Churchill and Roosevelt had almost the powers of a dictator. The writer feels that the main difference in regard to Russia is that the Soviet Union has been in a continuous state of crisis and national peril ever since the revolution of 1917. No one can deny that all the other nations can learn more from the Russian experiment than from the experience of any other nation.

Germany and Italy need special consideration. Right up to the time of the Napoleonic wars the former country consisted of some 1,800 more or less independent duchies, kingdoms, etc.; while Italy was divided into about a dozen kingdoms and states. They represent survivals of a state of affairs belonging more generally to an earlier medieval period. As the diagram (Fig. 54) suggests, after changing to a constitutional monarchy in 1870, they reverted (after Fascist revolutions in 1920 and 1933) to a period of military dictatorship with characteristic imperialistic aims, which was more like the later Middle Ages than modern social trends. The late evolution of the Balkan countries, especially of Albania, is suggested at the bottom right portion of the chart.

PART III

ENVIRONMENT, VILLAGE AND CITY

The City . . . "represents the maximum possibility of humanizing the natural environment, and of naturalizing the human heritage."—LEWIS MUMFORD.

CHAPTER IX

SOME CHARACTERISTICS OF OCCIDENTAL AND ORIENTAL TOWNS

IN preceding chapters the agglomerations of man known as races and nations have been discussed, especially in regard to environmental control. The third agglomeration which merits our attention in a study of the evolution of civilization is that of the town. We may digress for a moment to discuss the relative importance of these various types of human association. If we accept the round figure of 2,000 millions for the population of the world, then the average for the four main races (ignoring the very few Negritoes) gives us a figure of 500 millions as a unit of race. In the same way there are about thirty nations in Europe (the only continent which the writer has studied in this connection); and the total population is around 500 millions. Thus the average population of a European nation is about seventeen millions. This is a much smaller agglomeration than that of race, and the figure is not very typical of European nations since only one (Roumania) is nearly seventeen millions, while many are much larger or much smaller, as the following table indicates.

POPULATIONS OF CERTAIN EUROPEAN NATIONS
(About 1930)

<i>Largest nations</i>		<i>Smallest nations</i>	
Russia in Europe	130 millions	Albania	0.8 millions
Germany	69 "	Estonia	1.1 "
Britain	48 "	Latvia	1.8 "
France	42 "	Lithuania	2.2 "
Italy	43 "	Norway	2.6 "

Just as the first section, dealing with distributions of folk over the whole world, led to somewhat new ideas in regard to race, and should be of considerable interest to anthropologists, so also it is hoped that the discussion of European nations throws a little new light on some general principles of history. We shall find, I hope, that our next study—dealing with towns and villages—will lead to certain novel conclusions which may be of value to sociologists.

In the whole wide realm of geography there can hardly be a division which better merits close attention than that known as "urban" geography. So far as the writer knows, there is no complete study of this subject, though the urbanization of populations is the outstanding feature of our life today. For instance, in England in 1851 urban and rural populations were about equal, but by 1911 the percentages were 78 and 22. In Germany in 1910 the percentages were 60 and 40. In the United States in 1920 they were 53 and 47; while in a new land like Australia, in 1933 the figures were 64 and 36. Hence it is clear that all the "high standard" nations are moving in the same direction; and this is due, of course, to the economic factor.

In our civilization today the huge populations are filling up all the lands, so that a shift from an agricultural to a manufacturing way of life is general. Countries which a few decades ago were full of pioneers producing cheap food based on cheap land, are now themselves becoming industrialized. Even mineral exports are changing, and we may take Australia as an example. Many lands such as New Zealand and Chile used to import Australian coal, but today are using their own coal supplies. All these changes make for the growth of factory towns in lands which formerly knew them not. Hence a study of urban geography is vital in our survey of an evolving civilization.

The two largest cities of the world, London and New York, consist of populations each aggregating about eight millions. About 1911 there were sixteen cities in the world whose population exceeded one million. Of these three were in the United States, two in Russia, and two in Japan. Ellsworth Huntington¹ gives a useful table of the urbanization of various nations—based in this case on the folk living in towns of over 50,000 inhabitants—for about the same period.

PERCENTAGE IN CITIES OF OVER FIFTY THOUSAND INHABITANTS
(Based on Huntington)

England.....	48 per cent	France.....	21 per cent
Scotland.....	38 "	Belgium.....	19 "
The Netherlands.....	30 "	Ireland.....	18 "
Germany.....	25 "	Italy.....	15 "
Denmark.....	22 "	Switzerland.....	16 "

¹Ellsworth Huntington and Frank E. Williams, *Business Geography*, 2nd ed., New York, London, 1926.

Today there are over one thousand towns with a population exceeding 10,000 in the United States alone; and in many countries these would be known as "cities."

There is, however, no generally accepted figure which determines whether a cluster is a city, a town, or a village. Perhaps we may call a settlement with less than 500 folk a "village," while a "town" has a population of between 500 and 10,000. There is also a great difference of opinion as to the optimum number of folk who should form one such agglomeration, whether town or city. There is some evidence that a figure of about 40,000 is well suited to present urban conditions. Perhaps we may say, therefore, that a figure between 10,000 and 40,000 is the size of the typical cluster with which the term "urban" geography is usually associated.

The giant city of today—which Mumford has christened "Megalopolis"—unwieldy and unaesthetic as it is, has passed through the five early stages of pioneer dwelling, village, town, city, and metropolis, before it reached its present self-suffocating condition. Hence our study of the city necessitates a discussion of all the earlier forms of urban agglomeration, if we would understand its evolution. In other words, this present section of our study is concerned with the third and smallest human agglomeration in all its stages, though the "climax" condition may be thought to be a city of about 40,000 people. To sum up, therefore, we may say that racial clusters contain about 500 million people, national clusters about seventeen million, and urban clusters about 20,000 people—to take an average-sized town.

In the space available in this book, consisting of a couple of chapters only, it is impossible to do more than touch upon a few of the interesting problems offered to the geographer in regard to urban life. I shall therefore start, as I have done in earlier sections, by a general survey of the field, invoking to some extent our invaluable Zones and Strata technique.

TYPES OF VILLAGE AND TOWN SETTLEMENT

As usual there are two ways of reconstructing the developments of urban life, the archaeological and the geographical. We may investigate the past history of any given city, and thereby reconstruct the complete record of its evolution; or we may make a survey of the actual types of towns and villages extant today. We may be sure that as we

proceed to the margins from our centre of maximum urban development we shall pass through samples of all the stages that we need in our survey. In other words, we are again dealing with a phenomenon—town development—which has a “cradle” and which passes through progressive stages. Hence it should be susceptible to our Zones and Strata technique. This latter method is what may be called the geographical method of research.

Today in the Northern Hemisphere there are two major centres of advanced urban development: one is in eastern North America, and the other in north-western Europe. Roughly speaking as we move further and further away from these centres, the settlements become more and more those of the primitive and the pioneer. In these next few pages I propose to describe some of these early types which show how the cities of today have evolved. Needless to say, there are innumerable examples of all stages, but I shall describe only a few samples which have come under my own survey.

A useful preliminary classification of types of settlements divides them into *Occidental* (i.e., mainly industrial or based on European agriculture) and *Oriental* (usually occupied with handicrafts, and largely based on subsistence farming). In the sections to come I describe “settlements” of various types whose chief characteristics are given in the following table:

VARIOUS TYPES OF SETTLEMENTS

Type	Town	Country	Population	Characteristics
1. Oriental	Unnamed	Australia	12	Aboriginal “wurlies”
2. “	San Andrés	Colombia	80	Arawak village
3. “	Kano	Nigeria	89,000	Negro walled town
4. “	Pekin	China	1,556,000	Walled capital
5. Occidental	Timgad	Algeria	Few now 30,000	Roman garrison town Medieval walled town
6. and Medieval	Carcassonne	France		
7. Occidental	Waterways	Alberta	300	Pioneer river port
8. “	Port Credit	Ontario	2,000	Small industrial town
9. “	Charlottetown	Prince Edward Island	14,000	Small capital city
10. “	Toronto	Ontario	700,000	Large capital city

TWO ABORIGINAL SETTLEMENTS

In an earlier chapter it has been pointed out that the culture of the Australian aboriginal is probably the most primitive that survives today.

This is, of course, due to the remarkable isolation of Australia from almost all other peoples, until the settlement by the British at Sydney in 1788. The writer has seen many of the aboriginal "settlements," such as they are, and there is little doubt that the Australian aboriginal of today has preserved something of the culture of our forefathers in, say, Aurignacian times (about 40,000 years ago). Readers should make a point of comparing the sketch given in Fig. 55 herewith with the drawings of an Aurignacian village given in the Quennells' fine book on European prehistory.²

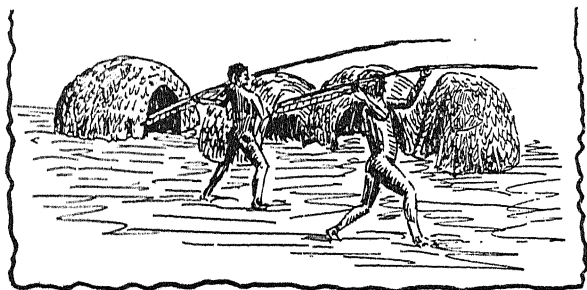


FIGURE 55.—Sketch of a cluster of leaf-covered huts or "wurlies" in north-east Australia. The aborigines are throwing spears with womerahs (levers).

Throughout Australia wherever the blackfellow is still little affected by the European culture, he builds the same type of hut, which is called a Wurlie or Gunyah. The aboriginal is a semi-nomad, though he keeps to his own particular hunting ground with great care. His wurlies are erected near permanent water, and a new cluster is built when the old becomes too dirty. Whether the wurlies be in north-east Queensland, as in the samples above, or in the arid plans of southern or western Australia they all look much like those sketched. The chief function of the hut is to protect the "abo" against wind at night, and to some extent against the sun in the daytime. Rain is not much of a trouble in a large part of Australia, and the roofs seen by the writer did not seem well calculated to keep out heavy rain.

In the south there is a tendency to have the doors facing the east, since the dominant winds are from the west, but this position naturally varies in other parts of the large island. The hut is circular in plan,

²M. and C. Quennell, *Everyday Life in Prehistoric Times*, London, 1921.

and ten or twelve feet across. It is about five or six feet high. It is constructed by inserting a number of stout stakes into the ground in a circle, and bending their tops to meet in the centre. Here they are tied with some vegetable fibre or roots. More and more boughs are loosely woven into the walls, and usually nowadays a number of sacks, or even blankets, are thrown over the leaves and boughs. There is no attempt at a door, and a small fire is usually kept burning just outside the entrance in the cool nights, which gives a good deal of warmth to the sleeper within. In south Australia there is sometimes a sort of low wall of boughs projecting from one side of the entrance to form a primitive porch or yard. In some districts large sheets of eucalyptus bark are used to form a rough hut, but the bough hut is the one that is generally used.

There is no furniture, though there may be a few wooden dishes ("Coolamons") shaped like a curved shield and about twenty inches long. The weapons of the "abo" are scattered about, the long spears being stuck in the ground nearby. In the sketch (Fig. 55) the men are shown about to throw their lengthy spears by means of the "womerah." This is a flat lever about two feet long which hooks into the end of the spear, and gives the thrower much greater power over his rather heavy spear. Except in regard to the prevailing wind, there seems to be no specific rule as to how the huts shall be arranged, so that we can hardly give the name of village to such a group of primitive dwellings. They are of interest primarily as giving us a clue to the very earliest type of fixed dwelling.

The next survey is based on one made in 1930 about 4,500 feet up the slopes of the Andes, at their northern extremity in Colombia. Here is the little village of San Andrés, and this aboriginal settlement has not changed much from pre-Conquest days. The huts are arranged in no particular order so far as I could learn (Fig. 56). Of the two dozen that compose the village, half are circular in plan and half are square. They vary from fifteen to twenty-seven feet in diameter and are about twenty feet high. The walls are made of lumps of mud, some eight inches across, held together by a loose framework of laths (Fig. 57). The outside of the wall is often daubed with a continuous layer of mud which, however, can be seen flaking off from parts of the sketched hut.

The roofs are made of palm thatch, and culminate in a central point, or in a flat ridge with projecting ends. In some cases a buttress

of mud surrounds the hut like a parapet. The doors are solid slabs of wood with projecting tenons which fit into holes in the sills—thus primitive hinges are constructed. The largest hut, however, has walls made of plaited cane strips. A plan of the latter, evidently the meeting place of the village, is inserted in the map.

There is little in each hut except a bench or stools, each carved out of a solid log and each with four short legs. I saw only one pot in the village, though there were plenty of calabashes (i.e., gourds), and many dishes and spoons made therefrom. A number of hammocks are suspended from the roof, together with string shoulder-bags (*machila*), of which each native usually carries one or two. A native

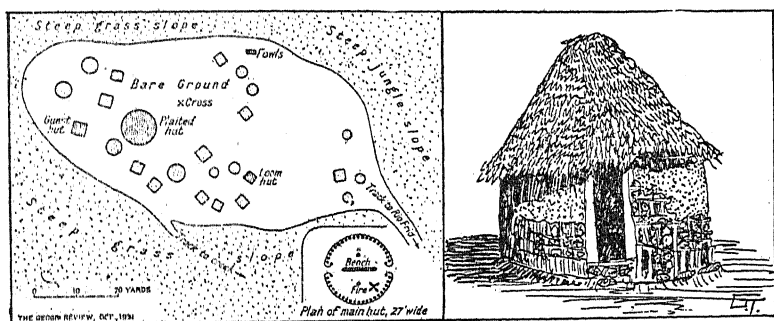


FIGURE 56.—Plan of the Indian village of San Andrés on the north-western slopes of the Sierra Nevada in Colombia, South America.

FIGURE 57.—Sketch of one of the circular huts in the village of San Andrés. It is about fifteen feet high and about fifteen feet wide.

loom, of a type formerly used as far north as the United States, is the most elaborate article in the village. Its frame is square, about five feet on each side. The clothes of the natives are all woven on this loom. A Spanish priest visits them once or twice a year, and a large wooden cross is erected in the centre of the village. Only one or two of the sixty adults seemed to know Spanish. I had no difficulty in making friends with these kindly folk; and though I was advised that rum was the sole way to their hearts, I found that a bag of small silver coins worked admirably instead.³

There were several shotguns in the village and a Spanish axe or two. The Indians pastured some oxen on the high grassy plateau (or

³See my study of Santa Marta in "Settlement Zones in the Sierra Nevada" (*Geographical Review*, October, 1931).

paramo) above the village; but apart from such intrusions their culture seemed to be wholly aboriginal. Early each morning the women and children go down many hundreds of feet through the jungle to their plantations in the deep valley of the Rio Frio. Here they cultivate bananas and beans. There were a number of poultry in the village, and we had no difficulty in obtaining such food as we desired.

The wattle and daub type of construction used for this little village in distant Colombia is much the same kind as that almost universal in Britain in the pre-Roman days. One has only to compare my sketch (Fig. 57) with similar huts which were built in the prehistoric village of Glastonbury, to see the close parallel.⁴

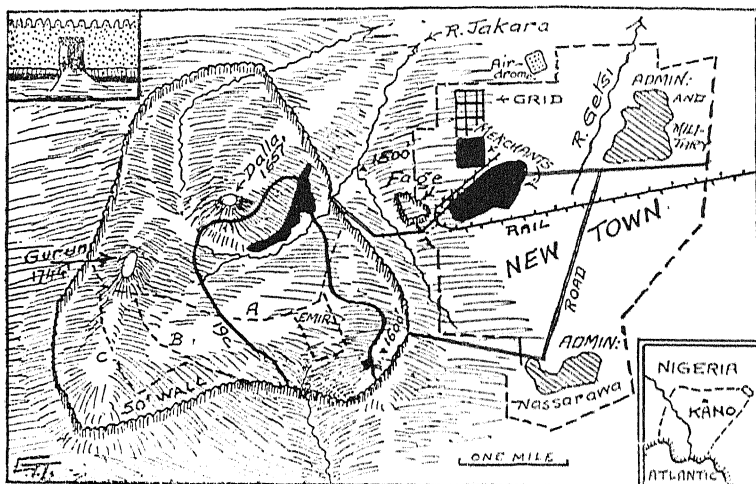


FIGURE 58.—The old and the new city of Kano in British Nigeria. The black patches are the industrial areas. The heavy black line shows the built-up area in the nineteenth century. (After D. Whittlesey, 1937.)

TWO ORIENTAL CITIES: KANO AND PEKIN

For my third example I have chosen a fairly typical town due almost entirely to oriental Negro or half-caste industry. I have visited various small Negro settlements in Algeria, Tunis, Egypt, and the eastern Sudan, as well as the kraals of Natal, but none of these seemed as satisfactory for this study as the town of Kano in Nigeria. Here

⁴See foot-note 2 supra.

Derwent Whittlesey has given us a remarkably full description⁵ upon which the following account is based.

Kano has a permanent population of about 89,000 and is situated some 600 miles from the coast (at Lagos), and about 400 miles to the south-west of Lake Chad. It is well within the tropics, in latitude 12° N., with a well-marked rainy season (of 36 inches) in the summer. Sorghum, millets, and peanuts are the chief crops. The town seems to have been founded about A.D. 1000 near the little "acropolis" of Dalla Hill (Fig. 58). This rose about 150 feet above the general level of the undulating plain at 1,500 feet, and was surrounded by the wall labelled A. For a time Kano was noted for iron-smelting for primitive weapons and tools, but the disappearance of the timber used for fuel led to the weaving of cloth becoming the chief handicraft.

Kano lies at the junction of a number of caravan routes connecting the Sudan with Tripoli. In the nineteenth century the walled city was somewhat triangular in shape, with a length of three miles along each side. Broken lines in the map show how the original town was extended to the south by the construction of further walls at B and C. The outstanding feature of the town is the crenellated mud wall which rises from thirty to fifty feet above the plain. One of the gates is sketched in the inset in the map. A deep moat filled with live thorns surrounds the outer walls. To quote Whittlesey:⁶

Inside the gates of the city are quarters for its keepers and defenders and their families. Beyond a belt of open ground rise irregular and congested blocks of buildings, occupying not more than a third of the eight square miles enclosed within the walls. These open lands are fields and gardens, intended to supply food for besieged citizens. At the north a wall is thrown out to incorporate a segment of a rivulet that provides water for irrigated gardens. Nothing is left of the abandoned city walls, the mud of which they were made having been promptly seized upon as material for the adobe houses of the town. They can still be traced by their moats.

There are two sorts of houses. One is an affair of mud built up of hand-packed balls bound with straw, and smeared with more mud to protect the core and to give a finished surface. The walls of the compound are continuations of the house walls, and rise six to twelve feet above the streets. The better houses may have a small second storey. The flat adobe roofs are reinforced by fronds of fan-palm. Rebuilding requires mud, dug from the nearest open spaces; and as a result the whole city is pockmarked with 'borrow' pits, some of which are 20 feet deep. The Jakara forms a deep pool in the city, and downstream is used for the disposing of refuse.

The northern bank of the Jakara, once the edge of the town, has become the central market, the biggest in west Africa. [It is shown black in Fig. 58.] Surplus

⁵Derwent Whittlesey, "Kano, a Sudanese Metropolis" (*Geographical Review*, April, 1937).

⁶See foot-note 5 *supra*.

grain, salt, French sugar and kola nuts are among the chief staples. The Emir and his officers occupy a good deal of ground in the southern part of the town, where the Emir's quarters are surrounded by a wall twenty-five feet high. The Fulani dominate the southern quarters and the Hausa the northern as well as the south-west. On the north-west edge of the houses are the Nupe and Yoruba quarters.

There have been many changes since the British occupied Kano in 1903, but space-limits prevent our giving much time to their description. The first quarters occupied by the British were at Nassarawa; and the new township to the east has no defensive wall, but a belt, 1,200 feet wide, of open ground surrounds the new town for defensive purposes. New administration and military buildings occupy the north-east quarter; while the central part is the scene of vast markets for local products, brought in by rail today. For instance, kola nuts arrive in large quantities in December. Kano is also a great centre for skins from all this portion of Africa. Camels and asses bring in a large part of the 150,000 tons of peanuts a year for which Kano is famed. In the north-west of the new town is a "gridiron" of streets where the foreign clerks have congregated.

Thus Kano illustrates the type of town life which is common throughout much of the primitive part of the world to this day. There are many parallels with European cities; for instance, the open spaces inside the walls were common in early medieval walled cities in Europe, though they were filled with slums later. So also the growth round a hill fort is very common in early towns, as well as the crude sewage arrangements, the moat round the wall, etc. The development of a new town outside the old is not unknown in Europe, though generally the new quarters submerge the old, as we shall see. Carcassonne gives us a parallel of old and new towns side by side. Salisbury and old Sarum in England are of the same type. The use of the gridiron plan for the new quarters is all too common in modern occidental cities. The wide use of mud is in part the result of the environment, since the long dry period enables such houses to last much longer than they would in rainier northern climates.

Pekin will serve as our example of a very large and important oriental city. It has developed under temperate conditions in a gigantic deltaic plain, in the north of the greatest concentration of human beings on this planet (Fig. 59). It is larger and much more complex than the previous example, yet it is rather difficult to show the special reasons which led to the early evolution of this huge city. The plain of the Hoang-Ho covers about 80,000 square miles; and one might have expected the chief city to develop on the river where it enters the plain, or in the centre of the plain, or where the river enters the sea. However, as early as 723 B.C. a town of "Chi" occupied the site of Peking. It is true that around A.D. 960 the chief city of the plain was at Kaifeng near where the river enters the delta lands; but in the

twelfth century the Kin tribes made the old town of "Chi" their capital, giving it the name of Chung-tu (Fig. 59). The Mongol conqueror Kublai Khan placed his capital of Khan-baliq on the same site. In both cases it was the desire of the northern invaders of the plain to have their centre of government in the north of China near to their own homelands. Peking has no river in the vicinity, though a string of artificial lakes indicates a former stream bed in the city.

The present population of Peking is about one and a half millions, but about half the Chinese city of today is only sparsely occupied with

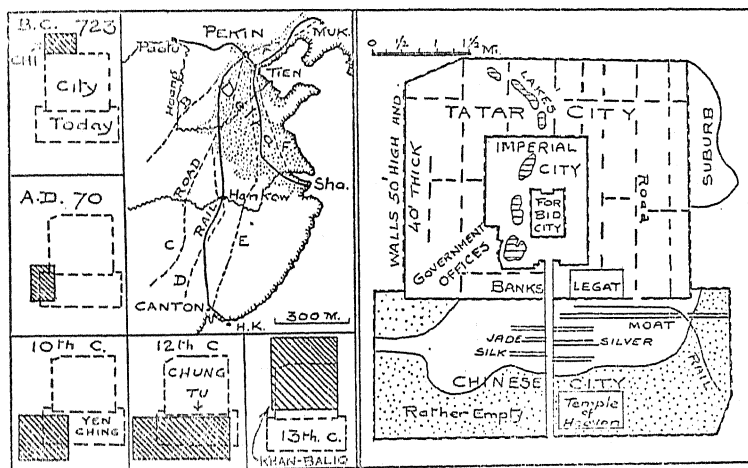


FIGURE 59.—Various maps showing the evolution of the city of Peking in the plains of north China. At the left are shown early maps from the *Encyclopedia Sinica*. A generalized map of the "concentric cities" of Peking is given on the right.

houses, the southern portion containing many temple gardens and large open spaces. Ancient moats surround both portions of the city, while from the walls the numerous trees in the palace gardens and temples make a picturesque and unusual scene in this bare and level part of north China.

Turning to the actual plan of this oriental city today, we find its arrangement is unique. The Chinese city consists of the usual narrow crowded streets of an oriental settlement flanked by innumerable small shops which cater largely to the tourist trade. The walls round this quarter were built in 1453, and are not quite so high as those round the

Tatar city, which are fifty feet high and forty feet thick. In the latter settlement the streets are broader, and the buildings larger and much more imposing. The foreign legations occupy the south-east portion of the Tatar city between the Hata Men and the Chien Men Gates. They are enclosed in high private walls, which enabled them to withstand the Boxer rebels in 1900.

The palace grounds of the Imperial City are beautified with the string of small lakes mentioned above. This city is enclosed within the Tatar city, and in turn protects the Forbidden City, where the emperors spent most of their lives. In the northern part of the Imperial City is a small hill (200 feet high) called Coal Hill. It is crowned by small temples, but is undoubtedly artificial in origin.

The Tatar city is covered with buildings, streets, and palaces; and though many Manchus live here, the majority of the people are Chinese. It is difficult to chart functional zones for this city, since the ancient and modern designs are somewhat at variance. The writer's visit in 1926 was too short for him to make a detailed plan. Originally the emperor's palaces and household occupied the Forbidden City. The government officials lived in the Imperial City, the ruling caste of Manchus in the Tatar city, while the subject groups of Chinese were in the adjacent but separate Chinese city.

Today the palaces are largely museums, while the government offices are mostly scattered throughout the southern half of the Tatar city, though some are still in the Imperial City. Probably the huge walls will be levelled in the near future, and the space converted (as in so many European cities) into wide boulevards and gardens. It may be noted that though large areas of the Chinese city are empty, yet there are a few small "suburbs" outside the walls, especially to the east of the Tatar city.

The present plan of Pekin is essentially oriental and medieval. But an enclave of occidental culture is being incorporated in it, especially in the southern part of the Tatar city. We may perhaps compare this enclave to the neo-technical sections developing in certain parts of occidental cities. (For example, see the writer's study of the towns of the Trentino, such as Trento, Bolzano, and Merano.⁷) The palaces clearly form the nucleus of Pekin, even though today no emperor

⁷My Presidential Address to the American Geographers in 1941 dealt with the evolution of towns (*Annals of the Association of American Geographers*, vol. xxxii, March, 1942).

lives there. Around them is an administrative zone, and beyond that the upper-class town of the Tatar city. Smaller shops and slum areas are rather characteristic of the southern Chinese city. The relation of the modern (i.e., from 1403 to 1911) capital to the great roads and railways of modern China is brought out in one of the maps in Fig. 59. The size of Peking drives home the fact that many important assets accrue to a city which has obtained the position of the capital of a country, even when there is nothing especially advantageous about the site.

The Tatar city is crossed by five main through streets running north-south, and by two or three which are interrupted by the Imperial City. The east-west streets are much less regular. Within these "blocks" the smaller streets are highly irregular and very narrow. In the Chinese city there is one long east-west street (about half a mile south of the Tatar wall) which runs right across, but all the rest of the streets are irregular. We shall see that this agrees with the general street plan of many of the medieval cities of Europe.

TWO EARLY CITIES: TIMGAD AND CARCASSONNE

Before turning to modern settlements, it may be well to consider briefly several examples of towns which show us what a settlement in classical or in early medieval times looked like. We shall see that in some ways they are more like the larger oriental cities than the industrial settlements of present occidental culture.

In the eastern portion of Algeria, about 100 miles inland from the Mediterranean Sea, is the ancient garrison town of Timgad. It was built about the year A.D. 100 by the Emperor Trajan for the soldiers of the Third Legion. They were defending the Roman Empire against attacks by the nomads of the desert, so that the garrison was on the very edge of cultivable land. Today the site is in the midst of rather poor wheatfields, and when the writer saw it (en route to the Sahara in the summer of 1938) the wheat was ready for harvest. But, owing to the very bad season, it was only about a foot high, and the yield of grain was very small. It will be understood, therefore, that this country does not support a very large population, and indeed no town has developed very near to ancient Timgad. The railway reaches Batna about twenty-five miles to the west of Timgad, and there is only one village (at Lambesi) in the intervening district. It is worth dwelling on this environment, because it explains the survival of Timgad. It is

the local inhabitants, using the ancient walls as a quarry for their own humble houses, who in general have ruined the relics of ancient Rome and Greece. If there are no adjacent houses the ancient city survives, as in the case in question.

The plan of *Timgad* is that typical of a Roman garrison town, and has remained relatively unaltered since the town was first laid out. It is in the form of a square of about 350 yards on each side (Fig. 60). The two chief streets are the *Cardo* running north and the *Decumanus Maximus* from west to east. The forum is in the centre of the town,

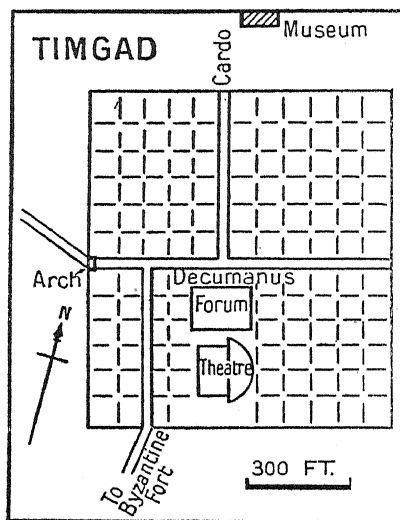


FIGURE 60.—A plan of the Roman military camp and city at Timgad in south-east Algeria.

with the large open theatre just to the south. Six large *Thermes* (baths) are scattered close around the city, but outside the square shown in Fig. 60. The Arch of Trajan has been well restored, and forms the entrance on the west side. The cross-streets cut the city up into about 100 equal squares, and give the site today very much the appearance of a gigantic chess-board. All the stone walls are fairly well preserved to a height of four or five feet, but there are no roofs, and not much above the level mentioned. The streets were about fifteen feet wide, but there were no gardens. The particularly military character of the settlement, and the proximity to the desert made it less attractive

than many of the other cities founded about this time. It was partially destroyed by the natives at the beginning of the sixth century. There is a large local museum there today, and just outside this is a simple fountain which flows strongly even in summer, and is probably the same source which supplied the Roman soldiers 1,800 years ago.

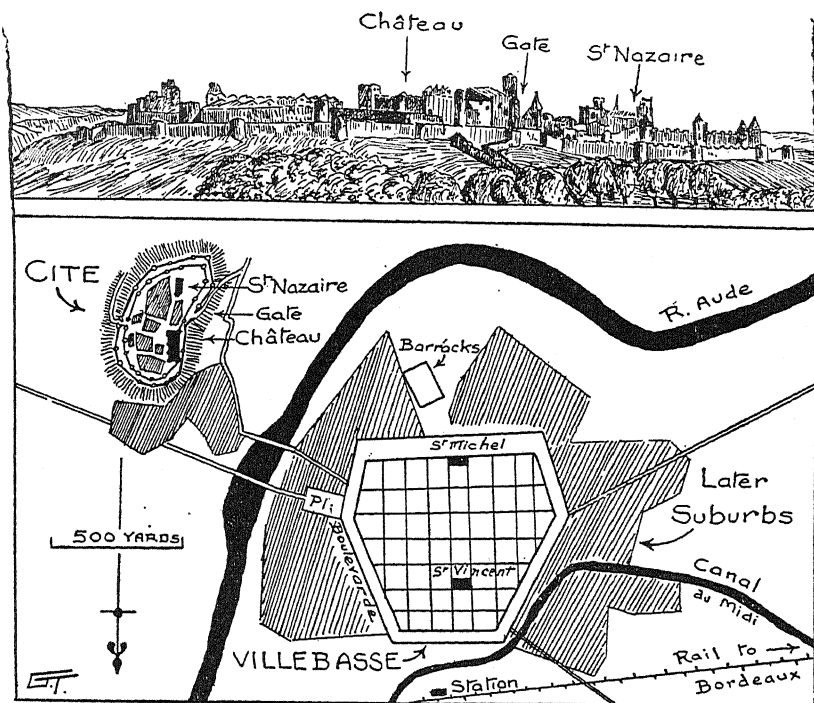


FIGURE 61.—Sketch of the walled “Cité” of Carcassonne in south France, looking to the south-east. The map also shows the newer “Ville Basse” across the River Aude, but the old walls have now been replaced by boulevards.

In the south-east of France, about forty miles from the Mediterranean Sea, is the town of Carcassonne (Fig. 61). This is accepted as the finest example in Europe of a fortified city of the sixth to the fourteenth centuries. Alongside is the “new town,” which itself dates back to 1262, and is a fine illustration of the way in which a medieval town has changed in the long years since it was founded.

“Carcaso” goes back to the days before our era when Rome con-

quered the south of France; and it was a fairly important town of the Narbonne province. It was fortified, and some of the Roman wall can still be made out under the later Gothic wall. The Visigoths fortified it in the sixth century, and much of the northern portion of the inner rampart dates from their period. The Goths held it against the Franks till 724, when they were expelled by the Moors. The latter in turn were soon driven out by Pippin of France. The *château* (or citadel) was built near the western gate in the eleventh and twelfth centuries, and the outer wall was probably finished about 1300. There are some fifty round towers on these two walls, many of which appear in the sketch at the top of Fig. 61; here we are looking to the south-east, i.e., away from the new town. The writer visited Carcassonne in 1938.

For about four centuries the old town was the headquarters of the Counts of Carcassonne. They became strong adherents of the Albigenses (i.e., "Protestants"); and suffered greatly in the Crusade of the thirteenth century conducted by St. Louis and De Montfort. Thereafter the town was attached to the French crown. In 1262 the chief citizens were expelled from the *cité*, and started the *Ville Basse* across the River Aude. This was protected by walls in 1347, the plan being a hexagon. The town was pillaged by the Black Prince in 1355. In 1560 the town was again in trouble for its Huguenot sympathies, and many citizens were massacred.

The walls of the new town were torn down in the nineteenth century, and their site converted into spacious *boulevards* (i.e., *bulwarks*). The modern city has about 30,000 inhabitants, and the chief trade is in wine. Only a few work-people now live in the crowded houses in the *cité*, together with the group which depends on the thousands of tourists visiting this remarkable survival. The Canal du Midi passes through the new town; it links the Mediterranean to the Atlantic at Bordeaux. The modern suburbs radiate along the main highways, and are indicated in the map. Hence we have here in one site early medieval walls, razed late medieval walls replaced by *boulevards*, and the modern radiating suburbs more familiar to most Americans.

FOUR STAGES IN CANADIAN SETTLEMENT:

McMURRAY AND WATERWAYS

We have now rapidly surveyed some of the salient characteristics of certain aboriginal, oriental, and medieval settlements. But with the

dawn of the industrial age, say about the year 1800, a somewhat new type of town was evolved in those temperate parts of the world where the culture was of European origin. It will be of interest to see the type of city which is developing in North America—and since the writer is now a Canadian (howbeit born in England and reared in Australia), the next four samples will be taken from places surveyed recently in the northern Dominion.

Our first sample is taken from the very fringe of pioneer settlement in the actual fur-trading territory of today. Needless to say it is far north-west of the earliest fur posts, which were at the mouth of the St. Lawrence. In 1778 Peter Pond explored the region north of Lake Athabasca, and about 1790 the North West Company established a fur-trading post at McMurray on the Athabasca River (Fig. 62 at A). It was situated on the main corridor of canoe travel from the Great Lakes to the Mackenzie River. The famous La Loche Portage linked the Churchill tributaries to those of the Athabasca. A rough wagon road of twelve and a half miles was constructed here in 1875, so that heavy goods could be placed on the Clearwater River (Fig. 62 at A).

McMurray, the settlement under discussion, grew up forty miles west of the portage at the junction of the Clearwater with the mighty Athabasca River. Thence goods could be sent down the Mackenzie system to the Arctic Ocean. In 1920 the railway from Edmonton reached Waterways on the Clearwater. Today the train traverses the pine woods of the taiga north of Edmonton once a week; I made my survey in July, 1936. At Lac La Biche is the last of the farming country, and north of that town the inhabitants are chiefly Cree Indians engaged in fishing and trapping.

The little towns marked hereabouts on the map usually contain fewer than half a dozen houses, so that it is somewhat of a surprise to find that there are two towns at the end of the railway. These are Waterways and McMurray (Fig. 62 at B).^s At Waterways there is deep water, and here are the large sheds of the trading companies, and alongside the wharves are berthed the steamers and scows for the Athabasca traffic. McMurray is still the centre for the local fur trade, and for the growing airborne traffic to the mining fields of the north.

How large has Waterways grown as the result of being the railway

^sWhen I was there first, in 1936, the railway ended at Waterways; a later description of this region will be found in my recent article "A Mackenzie Domesday: 1944" (*Canadian Journal of Economics and Political Science*, May, 1945).

terminus and steamer port? It was not a large city in 1936, for there was only one hotel, which was also the main store (Fig. 62 at C). There was another tiny store, but no school or church. Most of the houses, less than forty in all, were mere shacks arranged without any particular method along the main road or the railway. The water for

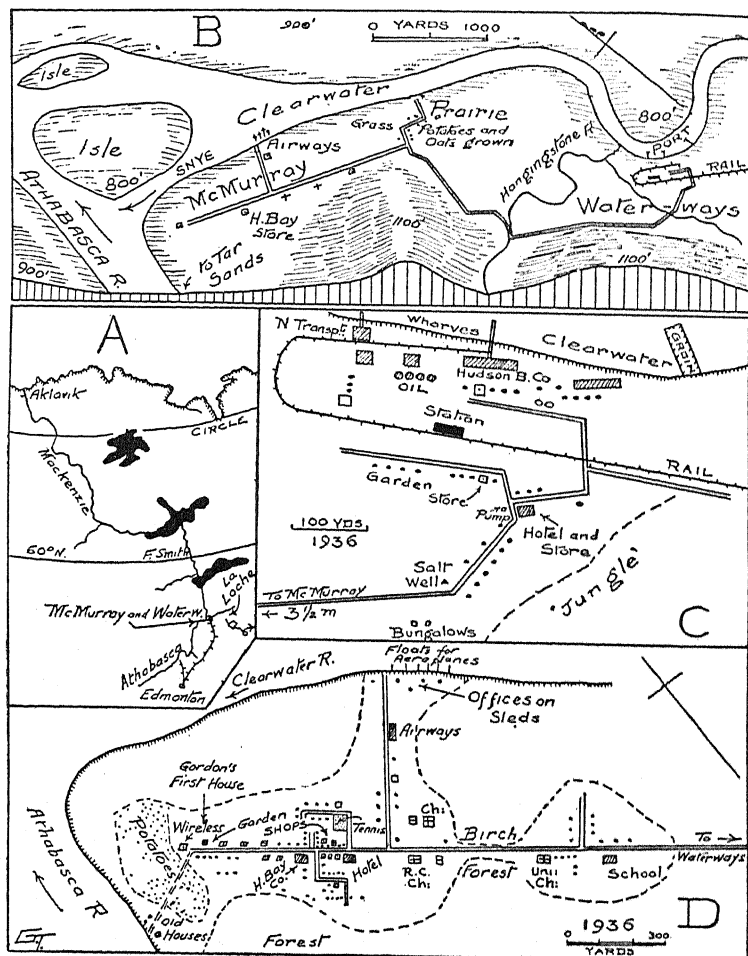


FIGURE 62.—Settlement conditions in the taiga of northern Canada. At A is a map of the Mackenzie basin showing McMurray as well as the La Loche Portage. The other diagrams represent details of McMurray (D) and Waterways (C).

the hotel was obtained from a pump across the road. Back of the village are rounded hills rising 300 feet above the river, and clothed in a thick temperate jungle.

Three miles away is the older settlement of McMurray, which is much larger than Waterways. The permanent winter population of the two places in 1936 was about 300 in McMurray and thirty in Waterways; but in summer many traders swell the population of both places. In McMurray there is one main street, about a mile long, which runs west to the junction of the two rivers (Fig. 62 at D). All the houses are shown in my large-scale map, as they were in 1936. They were almost all frame houses and one storey high, though the shops often have a false two-storey front. However, the Hudson's Bay store and the chief hotel were more imposing buildings, and many of the others were neat and freshly painted. There were three other stores besides the big company store, as well as three cafés, two butchers, two barbers, and a drug store. The bank, post office and dance hall were in the shopping block. At the west end near the big river was the wireless station; while a few fur-dealers indicated the main local product.

The air-transport offices in 1936 were on a branch of the Clearwater called the Snye (Fig. 62 at B). I was much interested to find that their haphazard arrangement along the bank of the river was due to the fact that each office was mounted on runners like a sled, so that during the flood periods in spring and autumn, it could be drawn to higher land to the south. At the time of my visit the three air companies were shuttling ten planes to and from the northern mining fields, notably those near Yellowknife.

McMurray is large enough to show the beginnings of functional zones. The oldest houses are at the river end of the main street, but the business centre is the block between the hotel and the Hudson's Bay store. The three churches and the neat little school have been built in clearings cut out of the birch forest to the east. There is not yet any differentiation into first- and second-class residence zones; so that it may be classed in what later is called the *juvenile stage* (page 229). Waterways is too immature to show any plan, and is in the *infantile stage*.

The site of McMurray is clearly determined by the junction of the two streams of canoe traffic via the Athabasca and La Loche. The steamer port was placed here because of the rapids in the Athabasca just above McMurray. The next similar steamer port is at Fort Smith

Rapids about 250 miles to the north. But the railway is unlikely to be extended to Fort Smith, since the air traffic is already reducing the importance of steamers and railways in the empty northlands. Apart from its junction position below the rapids, McMurray seems to offer no great advantage over many other sites in northern central Canada, though the presence of enormous deposits of tar-sands just to the south will greatly add to its growth in the future. However, these initial advantages in environment have given it a vital start, so that it seems marked out as the future cultural centre of this part of the northern taiga.

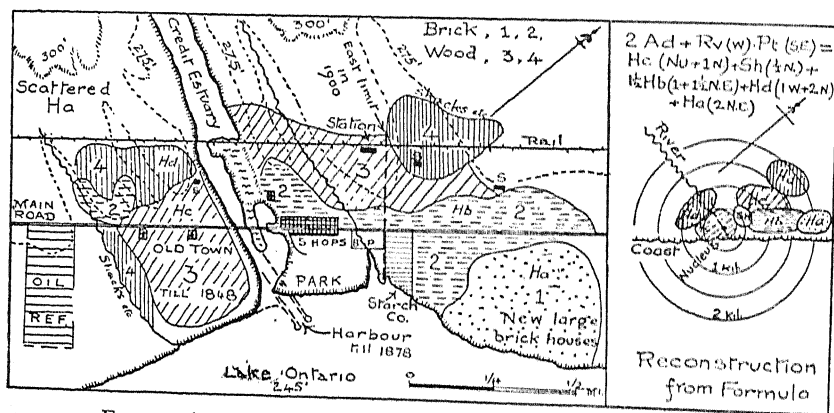


FIGURE 63 (left).—A functional plan of the little town of Port Credit, west of Toronto. Two contours are charted. The houses are in four classes: Ha, Hb, Hc, and Hd; the latter are mostly shacks. (Right).—A plan of Port Credit reconstructed from the formula shown at the top of the chart. It is to be compared with the actual plan on the left.

As the next stage in the development of a Canadian town we may consider Port Credit, which lies on Lake Ontario about thirteen miles to the west of Toronto. It has about 2,000 inhabitants, and having much the same environment as Toronto, to some extent gives us an idea of the pattern of Toronto when it was a small town of the same size. Port Credit was first settled in 1804, only a decade after the birth of Toronto; and until 1845 the settlement was confined almost wholly to the west bank of the Credit River (Fig. 63). Almost all the houses were wooden, and were mostly two-storeyed gabled residences, of which several still survive.

The decades around the middle of the century were quite prosperous,

and the little town had a considerable trade with the United States in grain and timber. There was a busy port, with quays, harbour works, and a lighthouse. But tariff laws ruined the grain trade with America, while all the large timber was exhausted in the hinterland during the seventies. The storms around 1878 demolished the harbour works, and they were never rebuilt.

The railway station was placed on the east side of the estuary in 1855; and this led to the development of a new town nearer to the station, in which the houses were built much more generally of brick. The population was about 450 in 1877, when the town contained three churches and three hotels; there are the same number today, with a population of about 2,000.

In 1900 the eastern portion equalled the western in area, but since that date there has been a great expansion to the east, as Fig. 63 shows. Thus Port Credit developed in three stages: the old wooden town in the west till 1850 or so; the modern brick and wood town between the station and the little harbour till 1900; and after that date the newer portion mainly in the east.

There are two large industrial plants, each giving work to about 100 employees. The starch company was founded about 1889, and the large oil refinery in 1933. Today the town contains two primary schools, a high school, two banks, and a large brick post office. The two rows of shops shown on the main street comprise three stores, four cafés, three realtors, three barbers, two butchers, a drug store, and a picture house.

The stage of development is *early mature*—as will be explained in the next chapter. Since this is the first survey in which I developed the technique of *town formulae*, a brief digression to explain this technique will, I hope, be of interest.

In a genetic approach to urban geography we are chiefly interested in the town as an evolving organism. We want to know its present pattern, how that developed, and where and why the town started. For the present we can ignore the street plan, the source of its trade, the extent of its umland, and a vast number of other interesting features of a town. I see the city as a series of zones expanding from the original nucleus, and usually conditioned in its growth by the surrounding environment, unless we are dealing with a city of the plains.

Several features, therefore, seem to be essential in our proposed formulae. We should know something as to the original site or nucleus;

as to the reason for its founding; as to its growth with respect to the nucleus. As regards the zones of shops and houses, we should know their width and position. Further, we might well include some clue to the stage of development of the town, and, of course, a reference to the total population.

In the formulae, which I have been using for a year or two now, the indices are given in the form of an equation. On the *left* side are found the population, the stage of development, and the position and character of the nucleus. On the *right* side of the equation, the character and position of the functional zones are indicated.

Let us run over the description of Port Credit, and see how our formula would work out. The population is 2,000. This would be represented by the figure "2" in the formula. The town was originally a lake port on a little river; and with regard to the nucleus of the town, the river is to the west, and the lake to the south-east. So our formula becomes $R_v (W.) Pt (S.E.)$. The stage of development is what we shall learn to call *adolescent* in the next chapter (i.e., *Ad*). Thus the general portion of the formula (on the left side) is

$$2 Ad + R_v(W.)Pt(S.E.).$$

The particular zones are obtained as follows. The present shopping centre has been shifted from the nucleus about half a kilometre to the north. Thus the shop zone appears as $Sh(\frac{1}{2}N.)$. The house zones should be given in order from the centre of the town outwards. Thus the second-class houses (*Hb*) form a zone with a centre about one kilometre north-east of the nucleus, i.e., $Hb(1N.E.)$. Then come the third-class houses of wood, which still surround the nucleus, but also cover a zone one kilometre to the north, i.e., $Hc(Nu + 1N.)$. The shacks *Hd* are found one kilometre west of the nucleus, and also two kilometres north, and so we get $Hd(1W. + 2N.)$. Finally the large brick houses (not quite mansions) represent class *Ha*, and are being built two kilometres north-east of the nucleus, i.e., $Ha(2N.E.)$.

The total formula comprises two sides of an equation as follows:

$$2Ad + R_v(W.)Pt(S.E.) = Sh(\frac{1}{2}N.) + Hb(1N.E.) + Hc(Nu + 1N.) + Hd(1W. + 2N.) + Ha(2N.E.).^9$$

To reconstruct a rough plan from the formula, we proceed as follows (see the right-hand map in Fig. 63). A large dot is placed for

⁹Further data on the drawing of such plans from various formulae will be found in the original paper "Environment, Village and City" (*Annals of the Association of American Geographers*, March, 1942).

the nucleus, and concentric circles are drawn, with radii increasing by half kilometres. We can add the river coming in from the west, and the lake shore along the south. The distance indices (in the brackets) show the position of the centre of a zone. Thus the shops can be placed half a kilometre to the north of the nucleus. If reasonable patches be drawn contiguous to one other in accord with the indices, we obtain a plan which is quite close to the actual pattern of Port Credit, and gives us almost all the characteristic features of the settlement.

CHARLOTTETOWN: A SMALL CAPITAL CITY WHICH HAS REACHED EQUILIBRIUM

A scientific study of towns and cities should use the evolution of the settlement as the key to the classification of the processes involved. This is true of various categories already considered, such as races and nations, but it is not easy to apply this method to towns. In the development of the normal large town or city, the new zones of mansions, or shops, or factories, do not stay "put," but are always being "submerged" by the centrifugal motion of the growing city. To take a striking example, the fine brownstone mansions which were occupied by the most privileged folk in Chicago not many decades ago, are now occupied as rooming houses by very poor Negroes, who, I am informed, do not hesitate to tear down doors or stairways if there should be an acute fuel shortage!

Thus it is not often in our very progressive and growing urban form of life that a town of some importance reaches a satisfactory stage of growth, and then remains at that level for many decades. This, however, has happened in one very interesting little city, i.e., Charlottetown, the capital of the Province of Prince Edward Island (Fig. 64). Although it is so small a town, with a population of about 14,000 only, yet it ranks with Montreal and Toronto as the capital of an independent province. Owing to the absence of coal, oil, or water power, on the island, there has been very little in the way of industrial development in the capital city. The whole island depends very largely on agriculture, and while Canada as a whole increased her population 181 per cent in sixty years, in Prince Edward Island the population has actually decreased by 6 per cent in the same period. In 1881 Charlottetown had a population of 11,500; in 1911 it was only 11,200; while in 1941 it had grown to 14,400. As the result of these somewhat stagnant conditions we shall see that the pattern of the city has "crystallized"

in a very interesting fashion; and there is little of the proliferation and overlapping that so complicates the zones in most growing North American cities.

The first settlement near Charlottetown was on Rocky Point, where a small fort was built during the French regime (Fig. 64, inset). In 1728 about 115 folk lived in the vicinity, but this number dropped greatly at the time of the conquest by the British. In 1764 a survey of the island was made, and Charlottetown was held to be the best site for the capital owing to "its central position, and easy communication with the interior by means of three fine rivers."

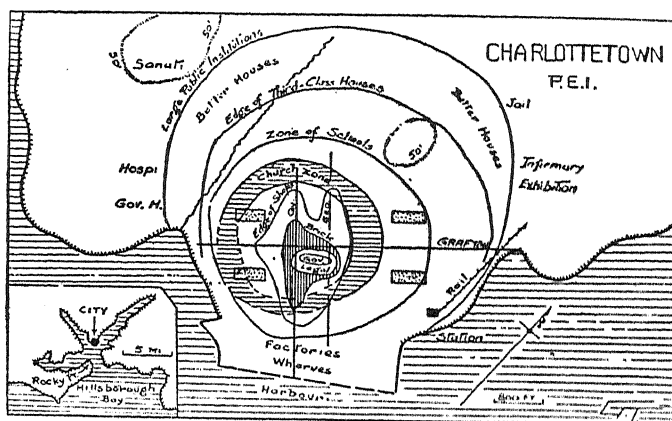


FIGURE 64.—A diagram of the functional zones in the provincial capital of Charlottetown, somewhat generalized.

In Fig. 64 a generalized plan of the city is given, with the permission of the censor.¹⁰ The city has been built on a promontory on the north side of the trident-shaped estuary opening into Hillsborough Bay (see inset in Fig. 64). This promontory nowhere rises to fifty feet, and not much of the immediate hinterland is as high as this moderate elevation. A minor cape in the west was set apart for a park, and contains Government House.

The main streets form a complete "grid," but only three of the streets are indicated in the diagram. Four small parks were laid out at the corners of the grid. These contain grass and large trees, and add

¹⁰The publication of the zones of the city has been withheld by the censor until the close of the European war, but a description is now available in the *Canadian Geographical Journal*, June, 1945, p. 274.

considerably to the attractions of the little city. Great George Street was the axial street, but as is so often the case the main shops have been built in an adjacent street, Queen Street in this case. The large Provincial Building (where the federation of Canada was decided upon) occupies the central position on the plan, with the post office and markets to the west. By 1878 the houses extended to the north to the edge of what are now the third-class houses (Fig. 64). In the last sixty years there has been very little change in the town pattern, save that a suburb of first- and second-class houses has grown up along the northern edge of the town.

I have endeavoured to classify the zones in this old-established city, and my conclusions are given in Fig. 64. In the centre is the block of administrative buildings. Closely surrounding this—mainly on the south side—are the legal and professional offices. Clustered along the central parts of Queen and Grafton Streets are the more important stores, built of brick and usually three or four storeys in height. Outside of this zone is a belt of wooden shops of less importance, which are found also in Great George Street. The many churches have almost all developed in a belt which is close to the four parks. Outside this again, and about one-third of a mile from the centre, is a zone which contains four or five large schools.

As usual the original houses within the city have declined in status, and are now mainly of third-class character. The better houses are naturally found toward the large park, and in the higher land to the north-west and north-east. The wharves and the railway areas have attracted the factories and the poorer houses. This tends to give us a zone of better dwellings about one mile away from the centre of the city. For various reasons, institutions such as jails, hospitals, race tracks, etc., are found in an outer zone beyond those so far enumerated.

Here, then, we have a simple pattern which perhaps indicates the normal arrangement of the functional zones of an occidental city, when undisturbed by "growing pains." The zones run as follows, commencing at the centre: (1) administrative; (2) professional offices; (3) better shops; (4) smaller shops; (5) church zone; (6) school zone; (7) third-class houses; (8) second-class houses; (9) first-class houses; (10) hospitals and institutions.

Consideration of the various stages in the growth of a really large city may be postponed to the next chapter where the evolution of Toronto will be described in some detail.

CHAPTER X

THE "SEVEN AGES OF TOWNS" AS EXEMPLIFIED BY TORONTO, CHICAGO, LONDON, THE RUHR, CANBERRA

BEFORE turning to the main purpose of this chapter, which is to show that a city in our industrial type of civilization tends to evolve through fairly regular phases, we may consider how the house types in a large city in North America usually change as it proceeds from the pioneer stage to maturity. Here again we are dealing with a problem which is susceptible to the Zones and Strata technique, as will be made clear by reference to the diagram in Fig. 65.

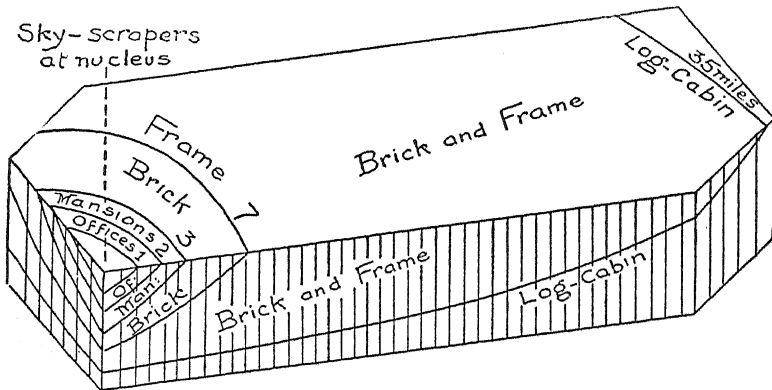


FIGURE 65.—A block diagram showing the zones of buildings gradually moving outwards as the evolution of Toronto progresses. The first houses were log-cabins, now displaced thirty-five miles from the city; and similarly with later types of buildings.

The first houses at Toronto were log huts, of which one is actually still preserved in the Exhibition Grounds in the city. This was originally erected where Queen Street crosses the Don River in the east of the town. The nearest log hut in use today, much as it was originally, is (as far as I know) in Queensville, thirty-five miles north of Toronto. Thus the first stage of house has now been "pushed out" thirty miles or so from its original position. The second type was the small frame

house built of horizontal planks. A few years ago I photographed one of these houses in the heart of the city, in Queen Street opposite Osgoode Hall. It has now been pulled down, but may well have been there for nearly a century. Other specimens remain in the corners of the city. They are now found fairly frequently in the little towns near Toronto; and we may say that they have been dispersed to a distance of seven or eight miles from the nucleus.

The wooden *farmhouse* (with barn) perhaps comes next. None is left in the city as far as I know; but they still occur on the margin at a distance of about five miles, as, for instance, near Wilson Avenue. The fourth type is the two-storey *brick house*, often with a snow-shedding gable in front. These are still common among the third- and fourth-class houses in the city. They are, of course, almost universal throughout lower Ontario, being the usual type of farmhouse built during the last century.

The remaining types are the mansions and sky-scrapers. The Grange was built in 1817, only a mile from the lake. It is a large mansion still in use as part of the Art Gallery. Today houses of this type and culture are not found nearer than Rosedale or Forest Hill, i.e., about four miles north. Finally, in the busiest part of the city we find the latest type of building, the sky-scraper, which is almost wholly found in the vicinity of Queen, Bay, and Yonge Streets. They, of course, constitute the most striking buildings in the commercial core.

The zones are therefore fairly definite today. If we assume that the few relics of older types still remaining are fragments of ancient "strata," most of which have been "buried" (i.e., removed), then the evidence given above shows how our technique can be applied to house and city evolution. In other words all the house types originated near the heart of the modern city (near the nucleus); but the older the type the further it has been displaced to the margins as the city evolves. Conversely from the distribution of these zones we can deduce the way in which the houses have evolved.¹

The data can be summarized in a table as follows, with the oldest types of buildings at the foot of the table:

¹This discussion of the evolution of Toronto is based on the article "Environment, Village and City" (*Annals of the Association of American Geographers*, vol. xxxii, March, 1942). The writer first used this technique for Chicago; see his paper "Geography the Correlative Science" (*Canadian Journal of Economics and Political Science*, Nov., 1935).

ZONES OF HOUSES

Order	Type	First Site	Present Position	Displacement from Centre
6.	Sky-scrapers	Centre of city	Centre of city	(Area 1 mile wide)
5.	Mansions	" " "	Margin of city	3 or 4 miles
4.	Early brick houses	" " "	Throughout province	?
3.	Wooden farm-houses	" " "	"	5 miles
2.	Frame houses	" " "	Especially in pioneer areas	7 miles
1.	Log-cabins	" " "	Obsolete	35 miles

It will be well to have a clear idea of the environment in which the capital city of Ontario developed, before we consider the critical stages of its evolution. This preliminary discussion will demonstrate the many disadvantages which accrue if a city plan is adopted which pays no attention to the topographic diversities of the site. In almost every city in North America—except in the great plains, where topographic control is obviously absent—the adoption of the “gridiron” or “chequer-board” plan has been well-nigh universal; and almost everywhere it has resulted in great expense and inconvenience to the later citizens. Toronto is no exception.

The topography underlying the city of Toronto is very simple. In a width of twelve miles, as shown in Fig. 66, there are only two tiny patches of rock visible. These occur along the floor of the Humber River just south of the old Indian settlement of Tei-ai-agon, and again on the floor of the Don just west of Donlands. (These are shown by small black ovals on the map.) The rock is a dark shale of Ordovician age, which was not used (unless made into bricks) for building. Everywhere else the whole countryside is buried deep in glacial debris, usually in the form of gravels, silts, or boulder clay.

There are two rather obvious levels in the city site. Near the lake is what I have termed the “City Plain,” between the 246 and 425 feet contours. Here the glacial debris is about sixty feet thick (above the shale). Then we reach the well-marked “Iroquois shoreline” about 425 feet above the sea, where the glacial “Lake Iroquois” cut out a steep cliff in the glacial debris about forty feet high. This is clearly visible in the map, and has had a great effect on the city growth. In the inset is a map of Lake Iroquois as it appeared about 15,000 years ago. It will

be seen that long gulfs ran into the higher levels, and that gravel and sand were torn off the cliffs and piled to the west in ridges, which are marked *E* and *F*. These gravel ridges are now covered with houses, but are indicated on the larger map (Fig. 66).

The last feature of note in the topography is a series of rather deep narrow ravines which have been cut in the soft debris by the abundant waters draining away from the ice cap, which covered much of Ontario in the ice ages. Today these ravines carry very little water except in the

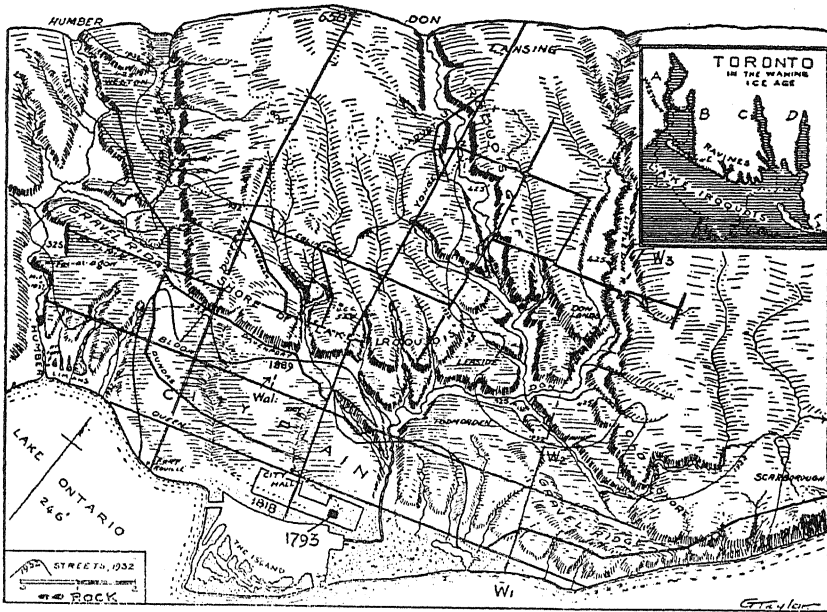


FIGURE 66.—A block diagram of the city of Toronto, showing the topographic features which have affected the evolution of the city. Inset is a diagram showing the locality at the Lake Iroquois period.

spring thaw, and they were not eroded by the present surface waters. It will be noticed that these ravines run from north-west to south-east, and do not enter the lake at right angles. From this fact has resulted many misfits in the street plan. When the present Lake Ontario developed, the storms of the lake tore away large masses of debris from the 300-foot cliffs overhanging the lake at Scarborough in the east. These gravels have built up a "hook" to leeward, exactly similar to the other ancient samples about 180 feet higher. This sandy and gravelly hook

produced what is now the "Island," which encloses a sheltered harbour. This was about thirty feet deep in the centre, when the town was founded in 1793.

There were a few French traders in the vicinity before this date, and the French authorities built two small forts near the mouth of the Humber about the year 1750. The site was visited by Aitken in 1788, as the harbour gave it distinct advantages for the arsenal which the English proposed to build hereabouts. In May, 1793, Governor Simcoc reached Toronto; and the fine oaks at the head of the harbour seem to have determined the position of the little settlement.

In 1791 A. Jones made a preliminary survey of York Township. He ran a road across the front of the township for about nine miles; and this is today known as Queen Street. Then he cut the hinterland up into blocks one and a quarter miles wide, separated by roads at right angles to Queen Street. These roads form Yonge, Bathurst, and Dufferin Streets, two of which appear on the map. Other main roads were laid out parallel to Queen Street at the same distance of one and a quarter miles apart. These give us Bloor, St. Clair and Eglinton, all shown on the map. Now the basis of our chequer-board is complete. I cannot do better than quote D. R. Keyes, who wrote on this subject as far back as 1913.

The plan of the future capital was drawn in that rectangular form which the military engineers of the Romans impressed on the conquered provinces of Europe. However suitable for the camp of a Roman Legion, this mode of laying out streets has proved far from practical on the American continent, where land is plenty and wars are rare. In its growth from the tiny rectangle enclosed by George, Duke, Berkeley and Front Streets there has been hardly any variation in the rigid angularity of its outlines. Neither hill nor dale, creek nor river, bluff nor ravine, has been allowed to deflect the monotonous straight lines of its streets.²

Thus long before the village of York (later to become Toronto) was big enough to be called a town, its future pattern was determined by the squares ruled on the government land-sale maps. Later we shall see some of the rather obvious "misfits" which have resulted from too rigid an adherence to such land-sale "gridirons."

Turning now to the attempts which have been made to classify towns, we owe much to the writings of Geddes and Mumford.³ As far

²Toronto *Natural History*, Toronto, 1913.

³Patrick Geddes, *Cities in Evolution*, London, 1915; Lewis Mumford, *Culture of Cities*, New York, 1938.

as the major classes are concerned, we may use their terms as applied to the occidental group of towns. Lack of space does not permit of anything but the shortest definitions, which may be summarized in a table as follows:

CLASSES OF OCCIDENTAL TOWNS

Type	Date	Characteristics	Sample
Eotechnic	Medieval	Defence city, with circular or stellar walls.	Carcassonne, Naarden
Baroque	Late, ditto	Palace town with geometric plan.	Versailles
Paleotechnic	Early Modern	Dominated by factories and railways, usually congested "gridirons," few gardens for poor.	Poorer parts in any city
Neotechnic	Late Modern	Largely planned by experts.	Canberra

In the present section I am almost entirely concerned with the industrial (Paleotechnic) type of town. It is the sub-divisions of this type which mostly interest geographers in our present civilization. I have already suggested that most such cities pass through a number of similar stages. It should be the duty of the urban geographer to integrate his data in this research, much as W. M. Davis did in his classic studies of the evolution of landscapes. But our problem will be more difficult, since our agent—determining the evolution of cities—is man, the irrational, while the agent in his case was ever-logical nature.

The "Seven Ages of Towns" have been worked out by the writer in connection with the city he knows best, i.e., Toronto. Let us first examine the salient features that we need to know in a genetic approach to our problem. They are the position of the commercial core, the industrial areas, and the varying characters of the residential quarters. The latter may contain fourth-class dwellings (*Hd*), i.e., small, inconvenient, or decayed houses without gardens; third-class (*Hc*), better houses, but still without much space or convenience; second-class (*Hb*), modern two- or three-storey brick houses with fair gardens; or lastly first-class (*Ha*), with rather large gardens for a town, and of a type that at times might be called "mansions." These types of residence are numbered 1, 2, 3, and 4 in the maps given in the stage diagram Fig. 67.

If we ignore the other details there, we see that there is a constant change in the position of these zones. This change takes place in two

ways. The best-class house of one decade becomes the second-class house of a later decade. But this change in zonal distribution is complicated by the building of new suburbs of various classes in the marginal and hitherto empty regions. There is, therefore, no very close resemblance between the development of a city and that of an animal. But

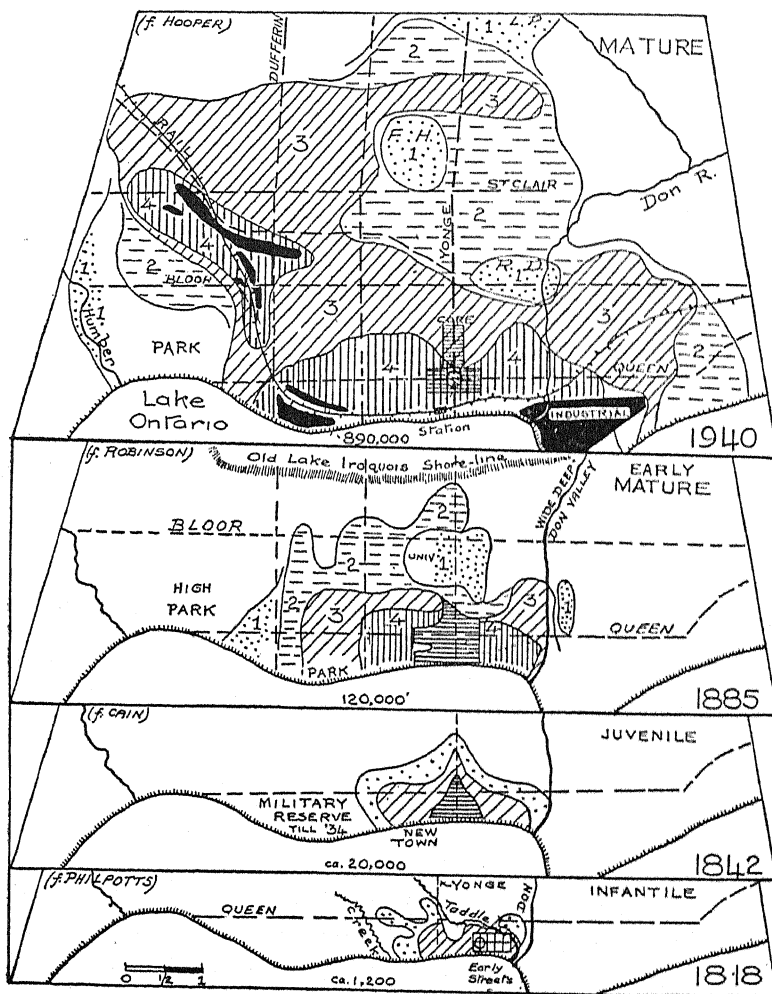


FIGURE 67.—A stage diagram to show the evolution of the city of Toronto. The four maps are to the same scale, the earliest at the bottom. 1, 2, 3, 4 are the four types of city residences, varying from mansions (1) to the poorest type (4).

it is something like the way a young tree grows. Its trunk and branches increase by a sort of expansion, while quite new characteristics, such as flowers and fruit, appear as it reaches maturity.

The lower diagram in Fig. 67 shows Toronto in 1818. The original "grid" of nine streets was laid out about 1790, on well-drained ground at the head of the enclosed bay, near the Don outlet; where also the best protection from naval attack was presumably to be gained. The junction of King and George Streets was the early centre of the city. By 1818 small industries such as tanning and brewing were scattered near the original settlement. A few larger houses were built on the margins of the town, but all except a few of the dwellings were built of wood. The population was about 1,200 at this time, and the built-in area covered about half a square mile. As usual in such a young organism it is not possible to distinguish the zones, which will only differentiate at a later date. This stage of the evolution of the city may well be termed the *infantile* stage.

By 1842 the town had about 20,000 inhabitants. The centre had shifted to the lower end of Yonge Street, which was now the main corridor to the interior. Swampy land at the foot of Yonge Street had now become the commercial core of the city. The built-in area (diagonal ruling in Fig. 67) now covered about two square miles. The poorer folk lived near the centre, in many cases taking over the better houses of the former stage, but also building new small houses in any empty space. This may be called the *juvenile* stage, and is illustrated around 1842 in Toronto.

The beginning of maturity is shown by a definite differentiation of the residences. The various types are displaced outwards as the years move on, though naturally examples of the early houses survive in the expanding zones. About 1860 the four classes of residences mentioned earlier were beginning to become evident. Poor quarters (4) clustered around the centre of the town. The best residences were on the margins, but were not numerous enough to form a connected zone. High Park in the west, and the ravines of Rosedale in the north-east, helped to determine the zones of the best houses (1). This stage is *adolescent*.

In the *early mature* stage of Toronto we see that the concentration of industrial areas along the railways, and on the "made" ground near the harbour is beginning, and is the chief change in the pattern. Toronto is still growing, but the main axis of growth (i.e., the central

line of the new industrial zone) is now along the railway to the north-west. There is a separation of the industrial city from the residential city, and the city is *mature*. (The early railways are not shown for 1885.)

In the last half-century the third-class houses have become the poor-class houses of 1940. The earlier first- and second-class houses have been hemmed in by the growing city, riddled with small shops and with small industrial establishments. They have become the third-class houses of today. The most significant factor perhaps is the network of railways, which determine the pattern of the industrial section. These needed empty land, and led to a great infilling of the margin of the harbour, which is now less wide by half a mile than in the early days. The old fort, which commanded the harbour in the War of 1812, is still preserved; but is now far inland and surrounded completely by the marshalling yards of the big railway centre.

The position of the best houses today is interesting. The development of Forest Hill (*F.H.* in Fig. 67) is perhaps due to the times of prosperity about twenty years ago, chiefly resulting from the new gold mines of the interior. The high rolling hills of glacial till, here about 300 feet above the lake, were beyond the city at that date, and were rapidly covered by large and expensive mansions. Possibly no similar development will occur again, since both the children in the families, and the domestic servants available are now rather rapidly declining in numbers.

Perhaps when a definite zoning is carried out according to a laid-down plan (such as is indicated in Canberra) a city may be said to reach its zenith or climax; in geographical language it is *late mature*. Such a city as Detroit, where much progress has been made in converting a "gridiron" city to a more reasonable "radial" plan, is near the late mature stage. The *senile* condition of a city is not indicated in Toronto, or in any progressive American town. Such towns as Peking, China or Nanking, with vast areas originally covered with houses but now heaps of ruins, may be described as partly *senile*.

The complexity of a large and ancient city is like the complexity of a long river such as the Nile. Parts of the Nile are juvenile (where it is still actively cutting its gorge), others are mature, and others *senile* (where it is sluggishly winding across the vast deposits of the Sudd). In a city, as in a river, these complex conditions are inevitable, depending on external factors developing during the life of the "organism." A new and interesting chapter, which cannot be touched upon in this

brief study, is the effect of the war industries on cities like Toronto. Vast industrial plants have mushroomed overnight, and new suburbs of tiny congested houses have sprung up in outlying corners. However, the general pattern of evolution seems to be as summarized in the following table:

THE SEVEN AGES OF TOWNS

Stage	Index	Characteristics
1. Infantile	In.	Haphazard distribution of houses and shops, no factories.
2. Juvenile	Ju.	Differentiation into zones (of houses and shops) starts.
3. Adolescent	Ad.	Scattered factories, no definite zones of Ha houses.
4. Early Mature	Er.	Residence zones fairly defined, no segregation of factories.
5. Mature	Ma.	Four zones of houses, separate commercial and industrial areas.
6. Late Mature	La.	Indications of advance to neotechnic development.
7. Senile	Se.	Large areas of town abandoned, remainder stagnant.

A MORE "CIVILIZED" METHOD OF TOWN DEVELOPMENT FOR TORONTO

The title of this section epitomizes the whole of "town planning." Only a few of the more geographical aspects of the problem, as they should have been applied to a city like Toronto, can be referred to here. It must be understood that Toronto is no worse than any other city. The citizens here, as elsewhere, are more interested in their own immediate good than in the distant development of the city; they cannot be expected to know how large a city will be fifty years after their interest has passed away. Yet whether the city be small or large there are two general principles which affect every town, and which are largely ignored. These two major principles are *topographic control*, and *centripetal traffic*. Let us examine them in some detail for Toronto.

As stated earlier the two outstanding features of the site of Toronto are (a) the Iroquois shoreline—a cliff about forty feet high about two miles from the lake shore; and (b) the deep ravines, often 100 feet deep, which run across the site from north-west to south-east. When the railways entered Toronto in the sixties, the Canadian Pacific (as it now is) was built along the foot of the Iroquois shoreline (Fig. 66). At that time this was the margin of the city; now it bars the north from the

south part of the city, save for a few congested steep streets. The lake shore about the same time was occupied by other railways, and as in so many cities little provision was made for crossing the obstructions.

When the city's centre seemed to be decided—as early as 1840—it would have been more scientific to have built a series of main corridors leading outwards to the north-west and to the north-east. It should have been obvious that most of the traffic would flow to the centre of the city. On the “grid” pattern of streets (unless one lived *due north* of the block containing the City Hall, station, main post office and chief offices) almost every commuter (by road) has to swing round two sides of a triangle, because no diagonal road has been provided. Thus twice a day each such commuter has made a journey about one-third longer⁴ than it would have been if the city fathers had exercised common sense.

In the west the roads should have followed the divides between the numerous streams and ravines. This would have given the desired north-west—south-east streets leading to the centre of the town, and would have necessitated fewer of the colossal and expensive viaducts which are so striking a feature of the modern city. For instance, Vaughan Road (Fig. 66), which is almost the sole example with this direction, is a much more sensible design than Spadina Road with the pair of viaducts which lead to it near St. Clair.

The rigorous adherence to the chequer-board leads to some rather absurd results. Thus we find that a *continuous* Walmer Road is marked in the middle of the city map (see Wal. on Fig. 66), but actually it is still in three isolated pieces. These sections are separated from each other by the Iroquois cliff, or by deep ravines, or by the railway. Woodbine Avenue (W1, W2, W3) has a gap three miles long in its continuity from W2 to W3. It seems hardly likely that the whole of the little Don valley will be filled up to enable the surveyor's design of 1790 to be maintained! Similar absurdities and inconveniences could be found in the plan of any large city based on the “gridiron”—and unfortunately many civilized citizens think that this is the acme of city planning. Some indication of a better method will be found in the later description of Canberra.

⁴With no diagonal streets a person living due north-west of the centre (i.e., 45° from north) has a longer journey in the ratio 1.42 to 1.0; at 30° the ratio is 1.38 to 1.0; at 20° it is 1.3; and at 10° 1.15 to 1.0.

THE RURAL-URBAN FRINGE OF A LARGE CITY

The writer was Professor of Geography at the University of Chicago for seven years, and while there was much interested in the plan of that remarkable example of urban agglomeration. Since very little has been written on the "approach" to a large city the writer's study should be found of interest, if only as an introduction to what will be a major research in the next decade or two.

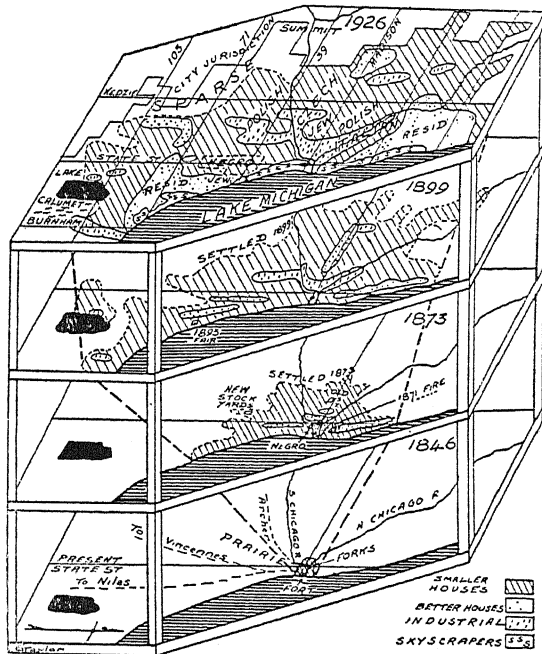


FIGURE 68.—A stage diagram showing the evolution of Chicago for eighty years. The skewed squares are four miles across. The heavy broken line, linking the four diagrams, indicates the spread of the outer zone of simple wooden houses.

The main features of the evolution of Chicago can be gathered from a stage diagram (Fig. 68) that I published in 1935, just after I had made the traverse which is reproduced in Fig. 69. The upper chart shows the city about 1926, and the outer city limits are shown by fine straight lines. The squares are four miles long on each side, and the north is to the right. In the lowest stratum (about 1846) is shown the site

of Fort Dearborn. This was built where the voyageurs paddled up the Chicago River, in order to reach the low divide at Summit, from which they could voyage to the Illinois River and so join the Mississippi system. At the Forks there were three inns and about a dozen huts by 1828. Farms existed on Madison Street in 1833, though today the nearest farm is at 143rd Street near Lake Calumet. So also private houses have been displaced from the Forks for about a distance of eight miles to the south, if one ignores one or two isolated examples buried among the shops. Forest covered much of the area south of Madison Street, and this was displaced about thirty miles to the south in the next century.

The growth of the city by 1873 and 1899 can be made out from the two middle strata (Fig. 68). The major features of the present city appear in the upper chart. Settlement has extended beyond the official city limits in every direction except the south-west. The centre of the city is now south of State and Madison in the heart of the sky-scrapers. These extend along the lake front for some ten miles, with an isolated area of towering apartments close to the lake near 53rd Street. The better-class residences are now mostly more than six miles from the "Loop," with long extensions to the south-west towards Blue Island. The industrial areas have spread widely, chiefly along the main railway lines or in the Lake Calumet area in the south. The Negro element has spread southward, occupying many former desirable residences between State Street and the lake. Very large Polish, Czech, and Italian communities build up most of the population west of the Loop. They are marked on the upper chart (Fig. 68).

In making my traverse (Fig. 69) to learn how a countryside was gradually affected by the encroachments of a large city, I chose the section along the two roads to the south called State and Halsted. They are parallel roads about a mile apart. The latter must be one of the longest straight city streets in America, for it is over thirty-three miles long south of the Loop at the centre of the city. It will be convenient to commence at the southern end of the traverse (i.e., bottom right of Fig. 69). Here we find a considerable number of small "villages," linked to the big city by numerous roads and railways, and being gradually changed from farm centres to suburban appendages of the city. Crete is thirty-three miles south of the city, yet its chief feature perhaps is the large golf links in the vicinity, which attracts numbers of folk from the city. There are many other golf courses,

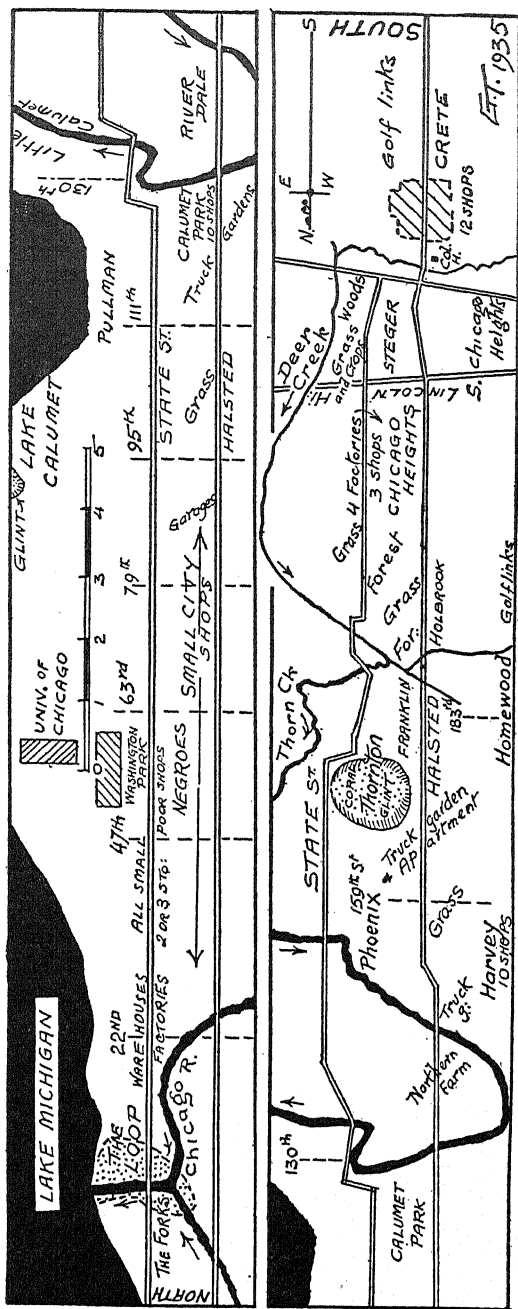


FIGURE 69.—A traverse (in two parts) south of Chicago for thirty-three miles, to show the character of the southern rural-urban fringe. The traverse was made in 1935. The dotted area near the Forks shows the size of Chicago in 1833. The lower map is to be placed to the right of the upper map.

some of very large size, south of Homewood (Fig. 69). Crete's status as a settlement may be gathered from the fact that it has four small shops to supply the farms and houses in the vicinity. There are about fourteen two-storey wooden houses on Halsted here.

Going north along Halsted we pass through pastures with some scattered trees (parkland) on the way to Steger. This has about a dozen small houses on the street. Just south of Steger is a fine colonial mansion with huge columns on the front like those so common in the southern states. The Lincoln Highway is crossed just north of Steger, and the landscape nearby is mostly pasture with trees. Chicago Heights has some small factories, and about six shops with many small houses near the traverse. (There may have been other houses farther from my traverse in 1934, but I did not chart these.) On the whole, grass fills most of the landscape in the vicinity of Holbrook. Near Franklin there is a race-course, with a shop or two and a dozen small houses.

At Thornton is a very unusual feature in the vicinity of Chicago, namely a large expanse of massive limestone, which is being quarried by gravel and cement works. This is charted in Fig. 69. It represents perhaps a circular mass of coral limestone (maybe an *atoll*) of Silurian age. Another such area (called a *glint*) occurs just north of Lake Calumet, and is shown on the map. In all the rest of the traverse the rock is buried deep in gravels or lake deposits.

Just north of Thornton and about twenty miles from the Loop, we found the truck gardens becoming more abundant. They supply vegetables to the big city. Here also was an area which in boom times had been cut up and where roads were laid out in hopes of a large sale. A solitary vertical-sided three-storey flat in the middle of the acres of open grassland showed that we were approaching a city, though similar apartments are absent in the next ten miles. Harvey had ten brick shops, five brick houses, and about twenty-four houses along the main street. Here grass and truck gardens were general, and in the bend of the Calumet River was the most northern farm which I noticed on this traverse.

The next suburban centre is Calumet Park, which is much like Harvey. The country to the north is again pasture and truck gardens, though to the east is the important factory centre of Pullman, where are great railway-coach works. About ten miles south of the Loop, we enter the city proper with the street lined with close-set small shops, though small artisans' houses are common at the southern end. This district soon becomes the main Negro quarter of Chicago (Fig. 69).

The shops are mostly two-storey, about half being built of wood and half of brick. Near 45th Street on State Street are some rather quaint Negro "churches" in converted shops. One such is labelled the "St. Luke Fire Baptised Holiness Church of God of the Americans."

About 38th Street the shops are larger and are mostly three-storey brick buildings, while at 23rd Street four-storey shops become common. As we approach the Loop at Jackson Street (about a mile from Chicago River) ten- to twenty-storey buildings are passed, though the finest buildings in Chicago are perhaps found farther to the east of our present traverse. A very interesting comparison could be made with the approach to the city of London (in England). This the writer surveyed in the same fashion in 1938, and the data may be published later in a book on the evolution of cities, which is now in preparation.

THE GROWTH IN AREA OF THE LARGEST EUROPEAN CITY—LONDON

No feature of the industrial age in which we are living is more characteristic than the growth of huge cities, which attract folk from the farmlands in a fashion which was unknown in the medieval period. London, until its pre-eminence was challenged by New York, was for many a decade the largest city on earth; and may well receive some of our attention in this study. Its geological position in no small degree accounts for its supreme importance in the early days of our history. It is the centre of the London basin as shown in Fig. 46. These soft strata, only laid down at the end of Tertiary times, were drowned partly through subsidence, and partly owing to the erosive action of the waves. As a consequence a fine deep estuary—that of the Thames—opens into the North Sea opposite to the even more important estuary of the Rhine. It is the nearest excellent port to the narrow Straits of Dover, for high chalk cliffs occupy much of the coast between London and Southampton. (At this latter site is a smaller Tertiary basin like that of London, and this explains the great importance of Southampton.)

Research in the London area shows that the early Gaulish tribes preferred the open woodlands of St. Albans and Colchester to the swampy flats of the Thames (top inset in Fig. 71). The first settlement was probably at the ford which crossed the Thames flats (here nearly two miles wide) near where Westminster is situated today. London (Welsh, Llyn-dun) is said to mean the "dark pool," which seems to refer to the wide sheet of water which covered the swamps at

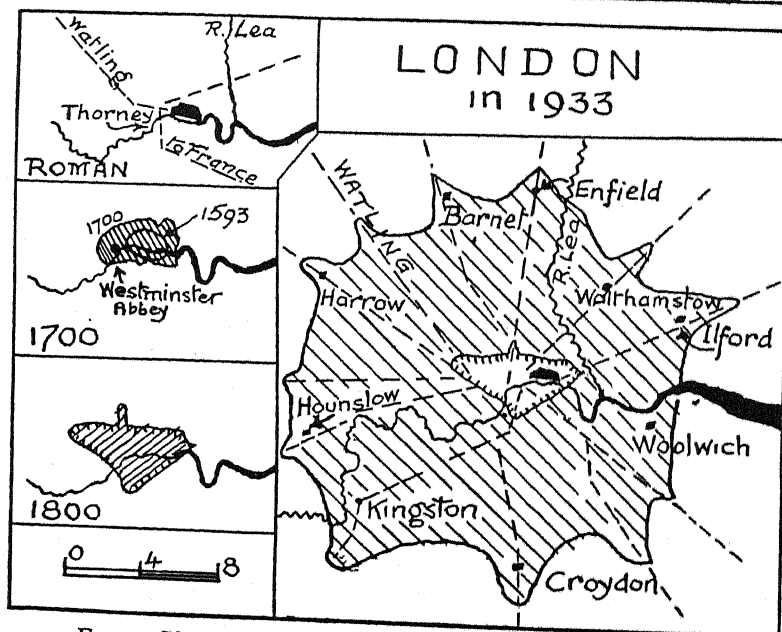
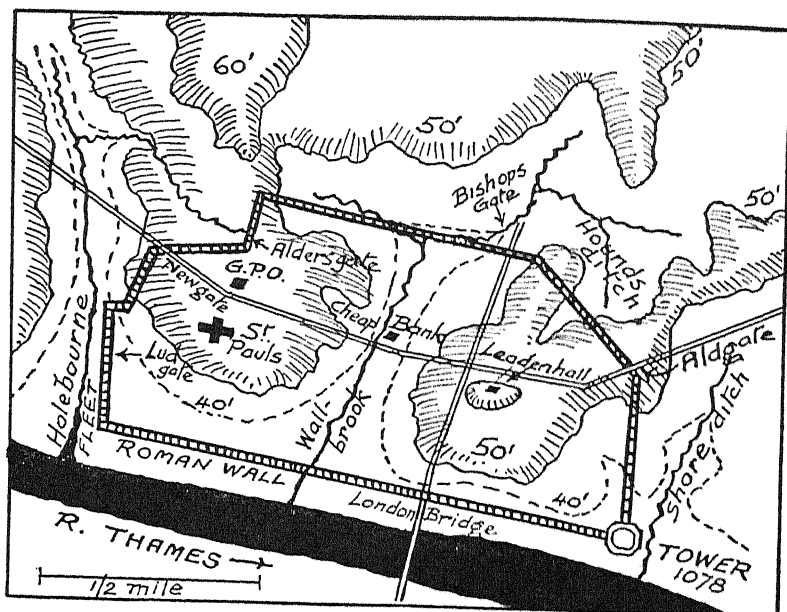


FIGURE 70.—(above) The topography in the heart of the city of London, showing the Roman Wall.

FIGURE 71.—(below) The growth of London from Roman times until 1933; all to the same scale.

high tide. The first rough road led from the chalk ridges of Canterbury and Dover to the Westminster Ford. Then the road proceeded north along the ridge between Ty Burn and West Burn; it was later known as Watling Street. (These places are shown in the little map of Roman times.)

Probably some time before the invasion of Claudius (A.D. 43) London became of some importance as a fishing port. At the mouth of the Hole Burn was a deep cove called the Fleet, where the small boats could be safely anchored (see Fig. 70). Still further to the east was a small stream (called "Wallbrook" later on) which flowed between twin hills rising to about sixty feet above the Thames; like it was Shoreditch half a mile east. These streams received tiny tributaries (cut in the gravels) running west-east, such as Houndsditch. The Romans built a fort near the present Tower, and then later, perhaps about A.D. 120 or 130, they built the famous wall. This enclosed an area of 330 acres, and made London the largest Romano-British town. The map shows how the builders skilfully used the various deep little valleys as part of their defence lines, so that Hole Burn (with the Fleet), Houndsditch, and Shoreditch became part of the deep outer moat (Fig. 70).

The Tower of London was begun by William the Conqueror in order to control the powerful city of London. To the west was the Abbey of Westminster begun by Edward the Confessor about 1065, and later to be surrounded by many mansions and palaces. Until the time of the early Stuart kings London did not reach to the separate city of Westminster, though fine mansions and gardens connected the two. The extent of London in 1593 and in 1770 is shown in the small map (Fig. 71); and it will be noticed that the growth has been definitely towards the west. Even by 1800 at the dawn of the Industrial Revolution there was little expansion except due west and due south. London now covered about ten square miles whereas Roman London was less than a square mile in extent.

The chief purpose of this section, however, is to demonstrate the sudden expansion during the nineteenth century, which is shown in the main lower map (Fig. 71) drawn to the same scale as the others. (It is based on Unstead.) Until several decades after 1800 there was a series of isolated villages surrounding London, and these are shown on the map. Croydon, Hounslow, Barnet, and Walthamstow were several miles away, but they have all been absorbed by the vast expanding

"organism" (made of bricks and mortar) which we call modern London. It is indeed something like a gigantic amoeba, with its fringe of pseudopodia (i.e., the houses on the radiating main roads) reaching out to swallow all that it touches. Today London is twenty-two miles across, and includes an area of about 270 square miles. Thus it is more than 300 times the size of the important city of Roman times.

For comparative purposes the growth of other cities since Roman times is inserted, with approximate early areas, in the following table.

GROWTH OF ROMAN SETTLEMENTS

City	Area in Roman Times	Present Area	Ratio	Population*
London	0.7 square miles	270 square miles	370	8,655
Rome	about 9.0 " "	10 " "	same	1,327
Paris	0.5 " "	100 " "	200	2,891
Vienna	very small	32 " "	?	1,918
Cologne	0.2 square miles	4 " "	20	768
Chester (Eng.)	0.1 " "	2 " "	20	44
Athens	about 1.0 " "	4 " "	4	392

*Population about 1939 in thousands.

CONURBATION AND "MEGALOPOLIS"

The growth of the vast cities already briefly discussed is one of the main characteristics of the Industrial Revolution. But even more striking is the development of the phenomenon which Geddes long ago called the "conurbation." It is well to dwell on such examples of human agglomeration, for they emphatically prove the control exercised by the environment on human affairs. In a sense London could be called a conurbation, since the city of London joined the city of Westminster in one solid block of built-in streets about the end of the seventeenth century. Since that date, as already noted, London has swallowed a dozen independent towns; now all included in the "Greater London" of over eight million inhabitants. But a conurbation more strictly means the welding together of several more or less equally important towns, and for this the vicinity of Manchester or of Leeds give us better English examples.

However, the best sample of a conurbation in Europe has developed in the vicinity of Essen in the Ruhr region in north-west Germany. The key to this unequalled collection of factories is given in the

geological section inset in Fig. 72. Here we see that a thick bed of very valuable "black" coal lies on top of the Older mass and is capped by the Younger mass. The coal layers dip to the north, so that the coal is right at the surface near Essen, but needs deeper and deeper pits as we proceed northwards. The River Ruhr flows along the southern outcropping edge of the coal, and here a string of coal towns developed in the nineteenth century, such as Essen, Oberhausen, Duisburg, Dortmund, etc.

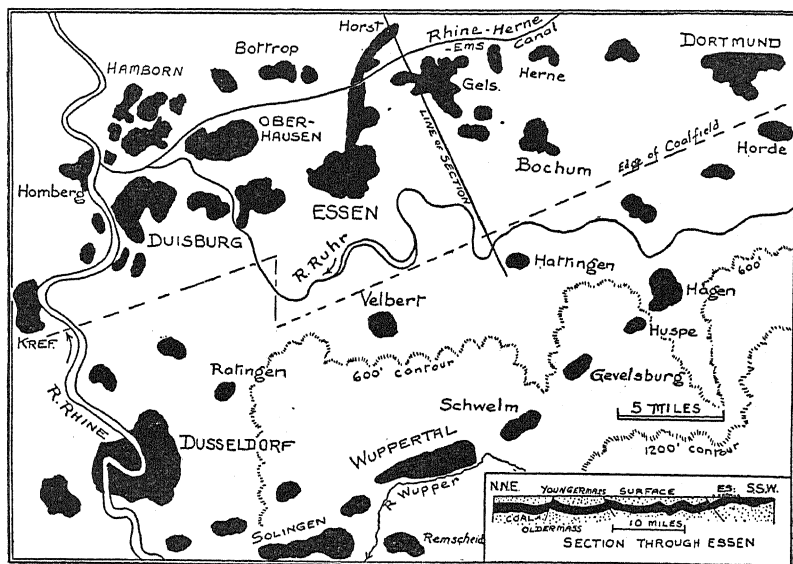


FIGURE 72—The conurbation of the Ruhr valley in western Germany, centred on Essen. A second example, along the valley of the Wupper, is joining Düsseldorf to Hagen.

About a dozen miles to the south is the rather deep narrow valley of the Wupper, and valuable iron deposits were found in the vicinity. Here a series of steel works developed, based on the nearby coal and iron ore. Today, of course, the main bulk of the iron ore comes from foreign sources, such as Lorraine, Sweden, and Spain. But the factories are still tied to the coal; and some forty towns have developed in this "black country" of the Ruhr.

The growth of many of these towns can be learnt from the following

table, which shows how they have increased during the later years of the industrial age.

TOWNS IN THE RUHR COALFIELD AND VICINITY
(Population in thousands)

Town	1939	1910	1871	Ratio 1939-1871
Essen	659	295	52	12.5
Dusseldorf	539	359	69	7.7
Dortmund	537	214	44	12
Duisburg Hamborn	431	330	33	13
Wuppertal	398	339	145	3
Gelsenkirchen	313	170	8	40
Bochum	303	137	21	14
Oberhausen	191	90	13	14
Krefeld	169	129	57	3
Hagen	151	89	20	7.5
Solingen	138	49*	?	?
Remscheid	103	72	22	4.5

*In 1905

Thus the towns of the Ruhr region have increased about ten times in their population since 1871. Since the nuclei of these towns were only about five miles apart at the start of the industrial age, it is obvious that they must now have begun to crowd each other in many areas. From Duisburg to the north-east as far as Herne, along the famous Rhine-Ems Canal, there is now practically one "conurbation." So also along the southern belt of factories, based originally on the local iron ore, there is almost another "conurbation," extending from Dusseldorf to Hagen up the rather narrow Wupper valley in part (Fig. 72). At the eastern end of these two conurbations is the huge centre of Dortmund and this city will soon link with Horde and Hagen. Hence we may see (if the R.A.F. have not destroyed the region too completely) ultimately produced a somewhat ring-shaped conurbation due to the linking of the two present-day groups already specified.

There is little if anything to be said for these conurbations as a feature in our civilization. They consist of square miles of smoky factories, usually destroying the adjacent countryside through the sooty pall which settles thereon. The workers live in monotonous grids of mean streets, and too often have neither the time, energy, nor capital, which would enable them to improve their environment. It is quite

unsatisfactory to depend on the benevolence of the factory owner for parks, museums, art galleries, and other amenities. In a better social system the profits of the industrial age would produce these amenities as a first charge. However, it is not for a geographer to dwell on these purely sociological aspects of the city problem.

Lewis Mumford's conclusions as to the seeds of decay inherent in a giant city should be read by everyone interested in our evolving civilization. He points out in his book *Culture of Cities*⁵ that the city rose as a special kind of environment favourable to nurture and education, because it was a protected environment. In the small city, co-operative actions prevailed over the more predatory modes of life. But the giant city tends to produce many of the evils of "crowd associations." Most forms of crime are more prevalent. Many activities are only pursued vicariously, such as the games and boxing matches. In time of war the "megalopolis" is particularly vulnerable from the air. Its huge populations are readily brought to the verge of starvation when outside supplies are merely interrupted. High land values and high costs of transport all increase with the congestion. Recreation spaces, at the rate of one acre for 300 persons, can be provided in reasonably-sized cities; but New York has only one acre of space for each 1,234 persons. However, Mumford sees the end of this unhealthy growth in the "cutting off" of the supply of new citizens from the countryside or elsewhere. After a city grows beyond forty or fifty thousand it fails to reproduce the full quota of its citizens. The decline of the birth-rate will cut down all immigration. These are perhaps the chief reasons why in the next stage of our civilization we shall see much smaller cities than today.

CANBERRA, A CITY BUILT TO PLAN

One of the most interesting human clusters is that of Canberra, the capital of the Commonwealth of Australia. Most of the world's chief capitals have been fairly large towns before they became of great political importance. For instance, there was a considerable population at Ottawa before it was chosen for the capital in 1858. However, Canberra belongs to this century's history, and every detail of its development is ascertainable. Moreover, the writer had a fairly close personal association with the capital, which may add to the interest of this brief record.

⁵Mumford, *loc. cit.*

In 1900 it was decreed that the capital should be built in the state of New South Wales; but, partly due to the jealousy of the other states, it was ruled that the city should not be less than 100 miles from Sydney (the state capital). Since the western part of New South Wales is so hot and dry, it was clear that the new city must develop in the rather elevated and wetter areas in the east of the state. After much discussion Canberra was chosen; and the territory around the capital, comprising 900 square miles, was vested in the Commonwealth on January 1, 1911.

The two first pastoralists settled in this district, about 150 miles south-west of Sydney, around 1823. One of these ranchers used the name "Canberry" for the district which surrounded his location; it is probably of native origin, though its meaning is not known. His head ranche house at Acton became the centre of the survey of the Territory begun in 1910. To the east was the ranche of Duntroon, and this is now the headquarters of the "Australian Sandhurst" or "West Point." The ranche house to the west, "Yarralumla," is now used as a residence for the Governor-General. The whole of the Federal Territory before 1910 was occupied by a score of "stations" (ranches), mostly raising sheep; but in the very rugged south-west section beyond Tharwa cattle are grazed. The total population of the Territory about 1910 was around 1,500. Apart from the main ranche houses there were only two or three other houses and an old church on the capital site. Most of these are indicated on Fig. 73.

It is interesting to look back over thirty years to the very beginnings of Canberra. The writer had described the physiography of the upper Molonglo (which flows through Canberra) as early as 1907 (in his study of Lake George), but did not actually visit the site until July, 1910. At this time the Federal Survey was housed in tents just north of Red Hill, where the Prime Minister's Lodge has since been built. To the north was an old brick building, which was reputed to have housed the convicts who helped the squatters (ranchers) in the early days of the settlement. Near the centre of the present city I found my first *Echidna*, the creature like a hedgehog in appearance, but so primitive biologically that it antedates the marsupials, and still lays eggs like a reptile. I roamed all over the Territory on a bicycle in those early days, preparing a contour survey from which a model was built. One day, before the capital was formally taken over, we raised the Federal flag in a huge eucalypt overhanging the tents. It was my

environment. The city has developed in a broad flat plain between three conical hills, which rise about 700 feet above the plain. The Molonglo River winds in its flood silts across this plain, running westward to join the Murrumbidgee River. The main vista is the view northwards between Black Mountain and Mount Ainslie. Here Commonwealth Avenue was made the axis of the chief corridor; and it leads northward from a low hillock called "Capital Hill" to the "Civic Centre" across the Molonglo River.

The cobweb pattern was adopted, with two main cobwebs at Capital Hill and Civic Centre. But other cobwebs were also laid out, most of which are still only in the embryo stage. However, in my sketch map (Fig. 73) I indicate a number of these lesser cobwebs, i.e., one northwest of Red Hill and three between the latter and the railway station. Another lies near Duntroon, while the largest cobweb of all is quite outside the sketch map to the north. The last is not yet bordered by any houses. It will be noticed that there is not much similarity between the simple early road pattern (shown by heavy broken lines) and the rather complicated cobwebs of today.

The actual arrangement of modern houses is indicated in Fig. 73, though every small street is not included. It will be seen that there are three or four scattered quarters separated by wide spaces where the streets have not yet been developed. South of Capital Hill are the largest houses with the Prime Minister's Lodge (*P.M.L.*) north of them. Another quarter served by a cluster of shops and a theatre is to the east of them. Still further to the east are the railway station, power house, and printing office with adjacent houses. Parliament House and the chief government buildings are about a mile north of these residential quarters.

The Civic Centre is three miles to the north across the river, and the other main sections of the town lie between it and Mount Ainslie. The latter sections occupy the once empty plain between the old rectory and the post office, where the writer investigated the claims of certain water-diviners way back in 1920.⁶

In the sketch map the streets in use are indicated, while some of them not yet laid out (near Red Hill and the railway station) are suggested by broken lines. Presumably similar streets will in the future

⁶See "Notes on Water-divining" (*Proceedings of the Royal Society of Victoria*, May, 1921).

fill all the empty portions of the map, as well as the flat plain north of the Civic Centre. A dozen small parks are scattered among the street blocks, but they are omitted in my sketch plan. The splendid plantations in the west of the city are an attractive feature, and a small hamlet has developed near the forestry building to care for them.

Clearly we have here a departure from the plans of most cities of today. The experiment of splitting up a small town of some 7,000 people into civic and political units is very interesting. The rather wide distance between the southern and northern clusters seems at present to waste a good deal of citizens' time.⁷ But in Canberra the designer is commendably looking forward to a city of three or four times the present size.

In concluding this chapter a few words may be said regarding neotechnic cities. Canberra may fairly claim to be an example of this type of city planning. There are a number of examples in most progressive countries: for instance, Hampstead Gardens near London, Letchworth some distance north of that city, and Welwyn, which has developed later. Romerstadt near Frankfurt in Germany is another example of looking forward in planning. Radburn in New Jersey is perhaps the best-known American example.

About 300 acres of Hampstead Heath were reserved for building. Each acre carries only eight houses, and a large portion of the area is left in parks or gardens or other open spaces. The roads are curved in accord with the contours, and where possible fine vistas have been provided. At Romerstadt long blocks of houses have been built with narrow grass-bordered streets. Large open spaces and terraces, where gardens are developed, are provided behind the building blocks. Curved blocks of four-storey shops are located in the centre of the settlement. There is considerable variety in the height of the various blocks, and they are so arranged as to get the maximum benefit from the sunlight. Future city plans elsewhere will move in this direction.

⁷In a letter from Miss Ida Leeson of the Mitchell Library, Sydney, I learn that Mr. Griffin planned to have the city built from the Civic Centre outwards as necessity arose. Kingston, the biggest of the urban centres, grew out of a workmen's encampment near the station, but this was not contemplated in his plan.

PART IV

GEOPOLITICS AND GEOPACIFICS

Geopacifics is an attempt to base the teachings of freedom and humanity upon real geographical deductions; it is humanized Geopolitics.

CHAPTER XI

ENVIRONMENT AS A FACTOR IN WAR — GEOPOLITICS

THE WORLD PLAN AND WORLD POPULATION

I commence this chapter with two quotations from a very suggestive book by the German Professor of Military Geography, Ewald Banse. In 1934 an English translation appeared of his book *Raum und Volk im Weltkriege*¹, so that an Englishman can readily obtain an idea as to how the Germans proposed to attack England. In Banse's opinion, "War is above all things a Geographical Phenomenon." A little later he declares: "Statesmanship is the skilful management of geographical resources—and the skilful interpretation of geographical possibilities." In the most interesting chapter of his book he gives "block diagrams" of England (much like that I have drawn in Fig. 47), and explains how the limestone *cuestas* (ridges) of the east of England were to be used by troops attacking the East Anglian counties to the north of London. He points out how the capture of the eastern *cuesta* gives command of the central industrial area as well as of the capital of the British Isles. *Fas est ab hoste doceri.*

For several years I have been lecturing in the Department of Military Affairs at the University of Toronto explaining the importance of a knowledge of the terrain—especially of its structure—to the undergraduates in the class. It has seemed to me quite important that any young officer in modern warfare should understand more than how to "read maps"; and how to find his way over a new district. He should know from the appearance of a valley "what is round the corner." He should be coached in the salient features which combine to form a *juvenile*, *mature*, or *senile* landscape.² He should know that *chalk* drains well and is a good site for trenches; while *clay* is usually disadvantageous. It is unnecessary, and in this book irrelevant, to go further into this physiographic side of military geography; but it is not irrelevant to our progress that so little interest is taken in this branch

¹Oldenburg, 1932; translated by Alan Harris as *Germany Prepares for War*, New York, 1934.

²See, for instance, Fig. 70 in Preston James's *Outline of Geography*, Boston, 1935.

of science in military circles (outside the University) in the Dominion of Canada.

In the first chapter of this book the general features of the world plan were pointed out. It is worth while to return to this topic to see if it throws light on the distributions of world power today; and we shall find that the position of the powerful nations to a considerable degree depends on certain features of the world plan.

In Fig. 9 I show a map of the world drawn so that all the continents are the true shape and true relative area. (This is managed by distorting the oceans somewhat.) In early studies of Australia I pointed out how much better it would have been for the settlement of that continent if it had been "shoved towards the south" by about 10° of latitude, i.e., by about 700 miles! This diagram in Fig. 9 carries that idea still further, and suggests how much better off the folk of the world would be if the "Tri-Peninsular Plan" (as it is now) could be transformed into the two elongated strips of land shown by the dotted belts! These lie between the 35° and 50° of latitude approximately, though the actual lines charted are the isotherms for 40° and 64° (Fahrenheit) respectively.

The basis for these two parallel belts is the well-known research of Ellsworth Huntington. In his *Living Geography* he writes: "Every species of plant and animal has an optimum temperature at which it thrives most vigorously, and man is no exception. For physical health among the white race as a whole, the best temperature is an average of 64° F. for day and night together. For mental activity the optimum temperature is a good deal lower than for physical, being an average of approximately 40° F. In other words peoples' minds are most alert and inventive when the thermometer falls about to freezing at night, and rises to 45° or 50° by day."

We may well study which climatic zones produce vigorous peoples. In 1916 the writer brought out one of the first studies of world climates from the point of view of comfort. It is entitled *The Control of Settlement by Humidity and Temperature*.⁴ In it certain arbitrary limits were chosen. These were based on wet-bulb temperatures, and on the writer's considerable experience in various polar, cool, warm, and tropical environments. As a result I decided that very comfortable climates occurred with monthly averages between the wet-bulb limits

³New York, 1932.

⁴*Meteorological Bulletin*, no. 14, Melbourne, 1916.

of 45° F. and 55° F. I defined as *sometimes uncomfortable* climates with an average per month of 55° F. to 65° F.; as *often uncomfortable*, those with one from 65° to 75°; as *almost continuously uncomfortable*, those with one over 75° wet-bulb. The following table shows how various places come out according to this list. Wellington (N.Z.) comes out best with eight months near the ideal. In the remaining four months, while some days are "muggy," many would be comfortable.

NUMBER OF MONTHS OF DISCOMFORT
(based on monthly wet-bulb)

Very Comfortable	Sometimes Uncomfortable	Often Uncomfortable	Almost All the Days Uncomfortable
Wellington, N.Z. 8	Wellington, N.Z. 4	Batavia 10	Batavia 2
Melbourne 6	Melbourne 6	Darwin 6	Darwin 6
San Francisco 6	San Francisco 6	Madras 6	Madras 6
Sydney 5	Sydney 7		Sierra Leone 12
London (U.K.)* 5	London* 3		
New York* 4	New York* 3		
Brisbane 3	Brisbane 4	Brisbane 5	
	Calcutta 3	Calcutta 3	Calcutta 6

*These places have a few months which are slightly below the optimum temperature.

I also worked out a sort of average comfortable climate based on a dozen large and flourishing centres of white settlement in both hemispheres. The averages for the hottest month were around 68° F. (dry-bulb) and for the coldest month 42° F. Thus they come out just a trifle warmer than those in the belts based on Huntington's optima for physical work (i.e., "brawn") and mental work (i.e., "brain") in Fig. 9. Possibly later research will lead us to modify some of these deductions, but there is little doubt that the belts whose climates have so far produced the energetic peoples with the most advanced position in our modern civilization are not far from the two indicated. (See also Fig. 99a).

Taking a broad view of the way in which man has exploited these two optimum belts, we see from Fig. 9 that there is a very definite pattern in the ensuing population spreads. The areas ruled in heavy diagonal lines have a population of more than sixty-four folk to the square mile; those ruled in a more open fashion have a density of sixteen to sixty-four per square mile.

There is no doubt that the most progressive portions of the earth,

if we combine mental and material progress, are the two labelled A and B., i.e., most of Europe and eastern North America. As regards numbers involved, the European area A contains about four times the folk who live in the American area B, though the general standard of living is, of course, much higher in B than in A. Both of these areas are completely within our optimum belt—which is in large part the key to their progress. (Other factors will be considered later in this section.)

Clearly the next ranking area in our northern group is D, which includes the 500 millions of China and Japan. These live largely in the optimum belt, but a good deal of the southern portion of D is too hot to produce very energetic folk under present conditions of life. (Central cooling will be referred to later.) The last of our four areas, last in initiative and progress also, is India (C), with its 300 million folk comprised of so many opposed races and cultures. It lies outside our optimum belt.

These well-defined centres of population and of present or future power are not due to human choice as many of my "Possibilist" geographical friends would like to be able to pronounce. They are the clearest possible proof it seems to me that nature (or environment) is the chief determiner of one of the most important aspects of life on the world. The environment decides where the great populations live, and which shall be the most energetic. In a word it is the key to the position of the great sources of manpower; and, as our next section will show, environment also to a large extent controls the supply of machine power and of mineral resources.

It will be noticed that there are other areas on Fig. 9 (which are labelled from E to L), which do not rival the four already briefly discussed. Let us look at the southern examples first, and try to answer two questions. Why did our civilization grow up in the Northern Hemisphere? Secondly, why is there no chance that the southern civilizations of the future can ever rival in quantity of output those already considered, though they may in the future produce some progressive teachers as valuable as those of the north?

We have already seen the answer to the first question in an earlier chapter. For reasons dwelt on several times, the centre of the Old World was the most stimulating environment and here civilization started. This resulted in no small degree from the largeness of Asia. As some writers put it, "The continental factor was necessarily greatest

in the largest land mass"; and this climatic factor was quite important in early evolution in many ways. Because the earth approximates to a tetrahedron, we find the major distribution of land concentrated in one belt around the North Pole. The writer frankly does not know why this land belt (centred near 60° N.) should be symmetrically arranged about the polar axis (Fig. 2). Mathematicians may be able to show that it is a function of the movement of the rapidly rotating globe about this axis. As a consequence of this distribution, there is no possibility of any large developments of land in the same latitude of the Southern Hemisphere. If we accept the reality of the tetrahedral world, this southern belt should be occupied mostly by the ocean, as is indeed the case.

Thus the advantageous areas labelled *E*, *F*, and *G* (in Fig. 9) are quite small. But it is significant that they contain large and progressive cities. The largest area of good environment is situated around Buenos Aires, which has a population of 2,345,000. In Australia, Sydney has grown to about 1,300,000; while in Africa Johannesburg (where the white settler is in competition with Negro peoples) has only 260,000. In these southern regions the reason for the discontinuity of the important settlements is clear enough; they are separated by wide seas.

The smaller regions shown in the Northern Hemisphere may now claim our attention (Fig. 9). They are *H*, *J*, *K*, and *L*. These lie on the warm side of the northern optimum belt, and are for the most part determined by the patches of good rainfall. In general much of this belt is semi-arid or desert. Such a belt naturally separates the Mexican area from that of the eastern United States. Egypt is shown at *L*, and all are familiar with the reasons for this heavy population (of fourteen million people) in what is in general a belt of veritable desert. The west African area at *K* is not easy to explain in terms of environment since it is almost the least attractive climate in the world from the comfort point of view. (See the uncomfortable months listed for Sierra Leone in the preceding table.) However, plant growth (and therefore human food) is luxuriant here with the heat and the moisture; and the Negro population has become immune to conditions which sap the energy if not the health of white folk.

A few words further may be given to the barriers between the *A*, *C*, and *D* areas in the Old World. Between *C* and *D* is the greatest mountain barrier in the world. The famous Burma Road crosses perhaps the most striking series of young mountain folds known to us.

Nowhere else do six major rivers flow along close-set parallel courses, as they do behind Burma and Yunnan (Fig. 28). Here in a distance of only 400 miles between Sadiya and Tatsienlu are the major gorges of the following rivers: Brahmaputra, Irawadi, Salween, Mekong, Yangtse, and Yalung. No important settlement can ever subdue this unkind environment except in so far as it puts a road across, to pass it as soon as possible. Between areas A and C are the high arid plateaus of Iran and Tibet which are not likely to carry many more folk in the future than they do now. Hence we are left with four major sources of man power, three of which are inhabited by millions of a very progressive type. How are other more material assets for military purposes distributed over the face of the earth?

WORLD RESOURCES OF COAL, OIL, IRON, ETC.

What is known as "heavy industry" was almost the prime factor in the Second World War. Almost all our weapons depended on huge supplies of iron and steel, and these in turn can only economically be worked in the vicinity of large sources of fuel. Of all fuels coal is still by far the most important, for it supplies eight or ten times the power based on hydro-electric supplies, and four or five times the power based on oil.⁵

Many maps have been published showing the coal, iron and oil, and water-power resources of the world; but most of them confuse the reader by charting innumerable small sources, which are of very little importance in a world struggle such as that which has engaged us. In the four maps in Fig. 74 I have endeavoured to select only those resources which are worth considering in a general study of what the Germans call *Geopolitik*. Their sole interest to the Germans is in their value for the arts of war with a view to the conquest of the world by the German Reich. But the student of *Geopacifics*⁶ (as I have ventured to label a study such as the present volume) is almost as much concerned in these distributions of power, since the production of "ploughshares" just as much as of "swords" depends on these same factors.

The older geographies gave the layman the impression that the

⁵See *The Economic Forces of the World*, Dresdner Bank, Berlin, 1927.

⁶*Geopacifics* is a hybrid word (like television or autobus) coined as a contrast with geopolitics.

distributions of coal, oil, and water power, were almost haphazard, and no general clues to their distribution were discussed. We can do much better than this today. For instance, let us take the distribution of oil first of all. (The figures given in the map are million barrels produced in 1939.) The United States is much the largest producer, with Texas

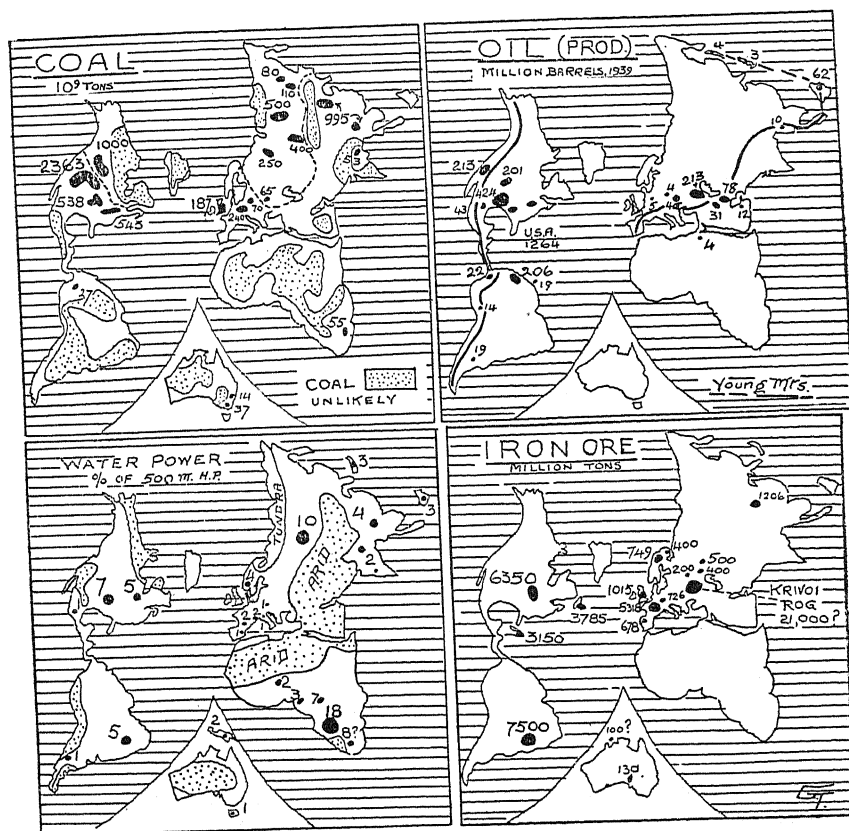


FIGURE 74.—Outstanding world supplies of Coal, Oil, Water Power, and Iron Ore, which determine the Power Nations of the world.

as the world's largest oilfield (424 million); California and Oklahoma are in the second rank, with more than 200 million barrels each. In the rest of the world only two regions equal these last figures. They are the Russian (Caspian) field with 213 million, and Venezuela with 206 million. A long way behind are the next pair, Iran (78) and Borneo

(62). Next comes Hitler's sole field of note, that of Roumania. This grew in production from 7 million to 46 million barrels between 1920 and 1939. No doubt in his dire necessity he considerably increased this output in the last year or two. Mexico has about the same production, while Iraq (31) and Colombia (22) may close our list.⁷

It is at once apparent that there is practically no oil in Africa and Australia (Fig. 74). As we learnt in the first chapter, these continents are marked by an absence of major young mountains. They have been relatively little affected by the great *folding* forces of the Alpine Storm. If we plot the general axis of the great fold-lines which dominate the young mountains of today, we find that they run close to all these oil-fields. This axis is indicated by the heavy broken line in the oil map. No important field (except the first discovered in Pennsylvania) is far from this line of late mountain-building. The close relation is due to the fact that the folding produces what we may term the "gasometers." In these the oil, seeping up from oil-bearing layers at shallow or unknown depths in the course of ages, has accumulated in lens-shaped hollows between the strata on the borders of the main folding. These hollows are popularly called "domes." They result from mild folding on the margins, but in the main mountain axis the folding is too sharp, and cracks (faults) arise which would spoil our "gasometers." It is clear, therefore, that the distribution of petroleum is linked with the major topographic features called the young mountains. In other words environment determines the positions of the oilfields.

Electricity based on water power is clearly dependent on two main features in the environment: first, adequate rainfall, and secondly, considerable elevation to produce the required "head." In this asset Africa comes out best, although its resources are as yet almost untapped (Fig. 74). Indeed only about 6 per cent of the total world supply is being utilized, in spite of the fact that the power supply unlike that of coal is inexhaustible.

This delay is largely due to the fact that the first cost of a hydro-electric installation far exceeds that for a coal-burning unit of the same power. It is stated that the total supply of water power available, but not used yet, was in 1925 about equal to 1.3 times the amount supplied by other power sources. A glance at the map shows that, in Europe, Norway—with no coal resources—is best off for water power. Africa

⁷Bank of Nova Scotia Review, 1940.

is the leading continent as stated, which is lucky, since it is very badly off for coal, as a glance at the coal map will show. Asia is second in rank in water as it is in coal. North America is ahead of South America; while Australia is very badly off owing to its aridity and lack of mountains. Only in Tasmania is there about 1 per cent of the world's water power. The following table^s gives the percentage of estimated world power available, and the percentage used.

HYDRO-ELECTRIC POWER IN WORLD
(percentages)

	Europe	North America	South America	Asia	Africa	Australia
Total resources	11.7	14	9	25	38	1.3
Utilized in 1925 (per cent)	39.6	43.6	3	12	0.1	0.7

It is not often realized by the layman what a very large proportion of electrical energy in use today is derived from fuel rather than from water-falls. In 1919, in the United States, coal furnished about 25 billion kilowatt hours out of a total of 40 billion; and in 1935 out of a total production of electric energy of 90 billion kilowatt hours, no less than 55 billion originated in the consumption of coal, and had no connection with water power at all. (C. F. Jones.)

The following is the order in which water power is being utilized by various nations. Germany uses 55 per cent of her available supply; Italy 47 per cent; the United States 29; France 26; Spain 23; Japan 21; Switzerland 18; Scandinavia 17; and Canada 12 per cent of what is available. If we consider total amounts used, the four leading nations are the United States, 10 million h.p.; and Canada, Norway, and Japan about equal with 3 million h.p. each. (Note that the map gives total power available, out of a possible 500 million h.p., not what is actually used.)

It is clear that the very large portion of the earth shown dotted, which is arid (Fig. 74), will have no water available for power, except in a few desert-crossing rivers. Not until we have moved some distance away to much higher rainfalls is there likely to be sufficient permanent supply for it to be worth while to sink large sums of money in building

^sBased on one in the Dresdner Bank publication mentioned in foot-note 5, *supra*.

great electrical stations. Here again it is not too much to say that hydro-electric power depends essentially on the environment. Man can only adapt nature's bounty; he cannot create it in this instance any more than he can create oil supplies.

The next product charted on the four maps in Fig. 74 is the most important. Coal is still by far the cheapest and most used basis of power for industry, except in a few special districts where no coal is readily available. We note that the Northern Hemisphere is much better endowed than the Southern. Out of a total coal supply of about 7,000 million tons (as estimated in the Dresdner Bank publication) probably less than 4 per cent is to be found in the southern lands. North America contains about 60 per cent of the world's total supply and Asia about 22 per cent; leaving only 18 per cent for the other five continents. It is true that recent surveys indicate some supplies of coal which have been discovered since these figures were drawn up, but they do not materially affect our figures, which in the nature of the case cannot be much more than a first approximation.

Is there any environmental reason for this very unfair distribution of nature's first gift to man? We can give a partial answer to this interesting question. Coal is due to several major processes. In the first place, there must be a widespread land vegetation, consisting of leafy material preferably, such as ferns, etc., growing in an environment like the Dismal Swamp of Virginia. Secondly, the vegetation must grow in a gently subsiding freshwater basin, so shallow that the plants can reach air, and grow up on a soil formed from their dead predecessors. This subsidence must be steady, or deep water and layers of silt will frequently cover the peaty vegetation. (These conditions are unfavourable for producing solid coal.) Finally, the peaty layer must be covered deep in later deposits to compress the whole and bring about the necessary chemical changes from peat to coal.

These conditions are not readily met with, though they have occurred on a large scale at several periods in the earth's history. For instance, in the brown coal beds of Morwell, Victoria, a bore penetrated 780 feet of coal. Ignoring a few silty layers, and assuming that each foot of this coal represents fifteen feet of peat, we have here evidence of a steady subsidence of about 10,000 feet. The land sank so slowly that peat plants could grow continuously on the relics of their predecessors for thousands of years.

Such conditions seem to have obtained most widely in the period called the Carboniferous, which occurred about 200 million years ago. Nearly all the black coal of the Northern Hemisphere was then laid down under conditions such as those mentioned above. In the Southern Hemisphere and in India these conditions did not occur at that time; though a somewhat similar environment developed in the Permian, giving us the valuable coals of Sydney (Australia) and of parts of India. The great deposits of the Rockies were laid down in the late Cretaceous. In the middle of the Tertiary period, about fifteen million years ago, similar conditions obtained in Victoria (Australia), with the result that the thickest bed of coal so far known (780 feet) was laid down. We can therefore say that certain periods of the geological record have been favourable for coal, notably the Carboniferous, and late Cretaceous; and it seems highly unlikely that further widespread resources will be discovered in the rest of the world.

It is true that in the Antarctic various explorers have found seams of coal in most of the deep glacial canyons which cut down through the great mountain barrier known as the "Antarctic Horst." Possibly here is a considerable resource, which may be used when the rest of the coal has vanished. So far, however, the specimens found have all been of low quality, and none of the seams is thick. The coal, like most in the Southern Hemisphere, is of Permian age.

In the map showing the coal distribution (Fig. 74) certain areas are dotted. These indicate those formations older than the Carboniferous, which have never been found to contain much coal (since land plants were not abundant until Carboniferous times); they also indicate the formations which belong to the very latest Pleistocene and Recent. In the latter case the peaty material, if present, is too new and too unconsolidated to have become coal.

Thus the coal resources of the world are in no small degree to be linked up with environments of the past, if not of the present. It has seemed to the writer that the fact that coal (derived from peat grown in rainy regions) is almost always found in places which today have a good rainfall, would seem to suggest that the world plan did not vary very much in the past geological times. This would seem to be an argument against the famous Wegener theory of Drifting Continents, which has never appealed to the writer.

It is not easy to give any rules for the distribution of the metal resources of the world. We know the phrase "gold is where you find it," and iron ore—which we must consider briefly—has still fewer indicators of its presence. Metals in general are found in the shields and other old rocks, or in association with very large igneous (volcanic) phenomena as in British Columbia, which in this case are of Jurassic date. The ores are brought to the surface from the central metallic portion of the globe as gases or in solution in hot waters. But there is another very interesting method of formation which is peculiar to iron ore. In any rocky bog or muskeg we often see rusty films on the bottom of the bog. This is iron secreted by certain bacteria, and in time it amounts to valuable deposits of "bog iron ore." It is believed that much of the iron ore in past geological time has been produced in this fashion. This is suggested for the vast deposits of Mesabi in the shield in Minnesota. The enormous deposits of oolitic iron ore (*minette*) in Lorraine are probably of the same type, though here they occur in Jurassic rocks. Similar ore in beds of the same age is found in the mines of north-east England.

The deposit of Krivoi Rog (Fig. 74) in the Ukraine is said by the Russians to be the largest in the world. The deposit is 160 miles north-east of Odessa, and is noted for the very great deviations which it produces upon magnetic needles in the vicinity. The same phenomena occur near Kursk (120 miles north of Kharkov), where large deposits of iron ore are also worked. The Lorraine field in east France comes next in Europe. The four high-ranking deposits in the New World occur at Itabira (Brazil), Mesabi (the United States), Newfoundland, and Cuba. Of these only the Mesabi field is being fully exploited, and indeed it is feared that this huge deposit will not last much longer in view of the enormous amounts used in the steel works of Pittsburg, Gary, and adjacent smelting areas. There are valuable deposits in the north of England, Russia, Sweden, and Spain. Germany has some supplies in the vicinity of Dusseldorf, but gets much of her ore from Lorraine, Sweden, and Spain.

The figures given on the map indicate the available amounts of iron ore. It will be noticed that most countries of Asia and Africa are very poorly endowed with resources of iron; and the following table is of interest in this connection.

TOTAL IRON ORE AND STEEL PRODUCTION

Visible Tons of Iron Ore *		Steel Production ^x	
1926		1926	1937
Europe.....	39 per cent of world	45 per cent of world	54 per cent
North America....	35 “	52 “	38 “
South America....	14 “	1 “	1 “
Asia.....	6 “	1 “	5 “
Africa.....	4 “	? “	? “
Australia	2 “	1 “	1 “

*From the *Engineering and Mining Journal*.

^x From the *Commonwealth Year Book*.

As regards steel production in Europe in 1926, Germany came first with 13 per cent of the world's total; then France with 9; Belgium 6; England 4; and Russia 3. In 1937 these figures had changed a little; for the United States produced 37 per cent; Germany 15; the U.S.S.R. 13; Britain 9; France 5; Japan 5; Belgium 3; Italy 1.5; Canada 1; India 0.8; and Australia 0.5.

HEAVY INDUSTRY AS A BASIS OF WAR

It is a platitude to say that wars will be won by the nations which can turn out the best and most munitions. Everyone knows that the Axis nations won so many victories at first because they had accumulated stock piles of munitions during the preceding five or six years, while the Allies had been engaged in peaceful avocations and had given little attention to the weapons of war. The importance of the tank and the airplane was recognized much sooner by the Germans than by the British and French; and Hitler had his "heavy industry" organized for these supplies years before the democratic nations. Heavy industry is essentially steel industry. It depends on three major factors: the presence of plenty of iron ore, an adequate supply of fuels for smelting, and a very large trained working force to produce the steel and the munitions.

The reader must be clear in his mind as to the distinction between huge supplies of iron ore and of fuel, and an adequate heavy industry. The various maps in Fig. 74 show us where the adequate raw materials occur, but they do not give us much of a clue as to where the heavy industry of today is situated. Canada has adequate supplies of coal and of water power, as Fig. 74 makes clear. But she is a young country,

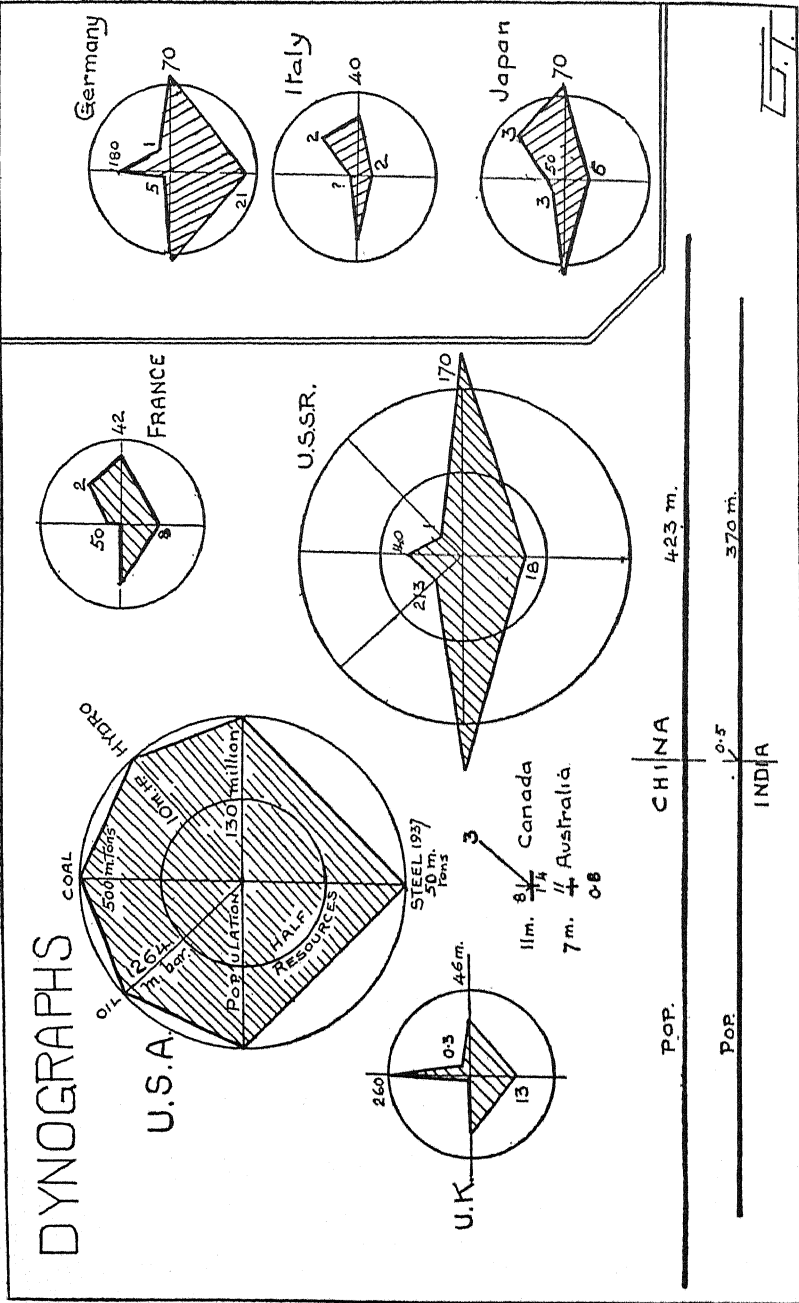


FIGURE 75.—Dynographs, i.e., graphs showing approximately by their areas the relative powers of the Axis nations and of the United States, the U.S.S.R., and the United Kingdom.

and we have not yet adequately developed the very notable iron ores at Bell Island (Newfoundland) or at Steep Rock, north of Mesabi. Moreover, there are only eleven million Canadians, so that the supply of skilled workers is limited in comparison with that in other lands. China is in much the same position as regards resources, though she has plenty of labour still quite untrained.

A rather new form of diagram is charted in Fig. 75 in which the conditions determining the presence of a powerful "heavy industry" are shown graphically. In these "dynographs" (i.e., graphs of power) we can see at a glance which nations were capable of turning out great numbers of planes, tanks, and munitions within the period of the recent war. Thus these graphs deal with actual production, rather than with total resources (as does Fig. 74). The data have been collected from a number of publications, and deal mainly with the period about 1938 just before Hitler disturbed all the national boundaries.

To most of my readers, conditions in the United States will be fairly well known. Hence I have made the production there the standard of comparison in every dynograph. For the United States (as with the other nations) the essential figures are added along five axes. Running west-east is the axis along which population is measured; and for the United States this is 130 million. For Germany the figure is seventy million, so that this axis is half the length in the latter dynograph. The coal supply of the United States is about 500 million tons, and this is marked off on the northern axis. For Germany the supply is around 180 million, i.e., about one-third as long a north axis. Hydro-electric power figures are ten million and one million horse power respectively, and are measured on the N.E. axis. The supply of petroleum for the two nations is shown by the figures 1,264 million barrels and five million barrels respectively (shown on the N.W. axis). Steel productions (50 and 21) appear on the south axis.

The general design of the dynographs should now be grasped by the reader. The graph for the United States is a "full-bodied" kite-shaped area, the ends of the axes reaching to the outer circle in each case. I have added another smaller circle of half this radius, which of course shows where half the resources would be plotted. This half-circle appears in the other dynographs, and enables one to see at a glance how each nation compares with the United States in any one of the five factors: population, coal, oil, hydro, and steel. It will be noticed that while the population axis extends right across the circle,

the others only extend to the centre. The enemy nations are isolated in the inset on the right.

A number of very interesting conclusions as to military power, as well as to present and future heavy industry, can be drawn from this Fig. 75 and from Fig. 74. Clearly, today, as regards fuel and steel production, it is almost a case of "the United States first and the rest nowhere." Steel production (as it was before the war; I have no accurate data for present production) is charted in the "Southern Hemisphere" in each graph. Germany, the U.S.S.R., and Britain added together just about equalled the United States in their steel production. Italy and Japan are quite small; and the rest of the world, except for France and Belgium, is negligible in a world survey.

A glance at the dynographs shows that the dozen here drawn belong to four classes. Those of France, Italy, and Japan have much the same shape and area. This indicates small coal supplies and a relatively large development of what hydro-electric power ("white coal") is available. Those of the three more important steel producers, the U.S.S.R., Germany, and the United Kingdom (i.e., Britain), have much the same shape, denoting plenty of coal and great steel production in consequence. At the bottom of the chart (Fig. 75) are four interesting graphs, i.e., those of China, India, Canada, and Australia. They are all nations of little importance in "heavy industry" at present. China and India have colossal amounts of man power as witness the elongated west-east axis; but the other four factors are almost too small to plot.

The new lands of Canada and Australia possess very little man power compared with the other nations charted. It is of high quality (as the Germans had to admit), and valuable quotas of special munitions were made in both countries. Only in hydro-electric power does Canada stand out, and this is suggested in the graph. Of course the aluminium industry of Canada (based on this power) is very important, but this resource is derived from oversea imports, and is not included in the factors charted. I have a firm belief that Canada will rank high as a manufacturing nation when the Alberta coal is utilized, but this is discussed in a later chapter.

In conclusion we may state that the United States is the sole well-endowed country in the world with a large population where heavy industry is exploited to the full. The U.S.S.R. is moving in the same direction rather rapidly; and probably if one could chart the steel and coal outputs of today the dynograph would look much more like that

of the United States. This graphic method of analysis seems to show that the United States and the U.S.S.R. (and perhaps China in the distant future) will be the world's great centres of man power and industrial development. India has the man power, but is rather poor in coal and iron. Australia's resources are small though they will grow perhaps to a state where a graph like that of the United Kingdom may be attained. Canada is so like the U.S.S.R. in its environment that it is absurd to think that it will not in the future have a graph like a small edition of the Russian dynograph.

This chart in Fig. 75 illustrates very forcibly some of Hitler's major mistakes. When France was conquered and Italy had joined Hitler, the nations with the three top-right dynographs were facing Britain (the U.K.) alone. Yet Hitler's vaunted intuition made him take on first the U.S.S.R. and then the United States. The stupidity of this policy seems fairly apparent—except that presumably Hitler somehow expected a knock-out victory over both within a few months. *Quem deus vult perdere, prius dementat.*

SOME SALIENT FEATURES IN GERMAN GEOPOLITICS

In the last year or two the general public has become to some extent "geopolitic-conscious." It is an important part of this book to explain some of the shortcomings of German Geopolitik; and to suggest that the best antidote to the German outpourings is to find out the truth about the geographical principles which they tend to distort.

Let us first of all discuss the origin of the concepts embodied in German Geopolitik. It takes us back a considerable distance in the evolution of geography, which has only been accepted as a serious scientific subject in the last half-century. In an early portion of the book it was pointed out that there are two schools of geographic workers. The first contains those who believe strongly in the importance of the environment, as controlling human endeavour to a large extent. These are the Environmentalists or *Determinists*, and to a moderate branch of this school belongs the present writer.

The other school sees the environment essentially as a field to be exploited by man. All the choice as to procedure lies with *him*, and he picks the best of many possible ways to develop a region. Here the stress is laid on the "many ways possible," and on the wide human choice which is offered. These are the beliefs of the *Possibilist* school.

The German *Geopolitik* belongs to an extreme and unscrupulous "wing" of the Determinist school, so that it behooves other Determinists to show the differences between the two "wings."

As far back as 1748 Montesquieu stressed the importance of the topographic factor in the affairs of man. This aspect of geography will be discussed at length in the next chapter. Herder (ca. 1790) and Hegel (ca. 1820) were German writers who discussed the importance of control by climate and soils. Ritter, a famous German geographer who flourished about 1830, was perhaps the first to write at length on man's adaptation to his environment; and he based his work in part on the famous voyages and journals of Humboldt from 1800 to 1826. Coming down to more modern times, Ratzel in a sense invented the term "political geography" about the year 1880. He had as a young disciple the son of a friend called Haushofer; and this lad became, forty years later, the founder of the German school of *Geopolitik*.

Ratzel was one of the greatest of geographers, but like many Germans he had a mystical turn, and gave to such terms as state and space unusual "dynamic" meanings, which the objective, not to say phlegmatic, Anglo-Saxon geographer does not appreciate, or indeed quite understand.⁹ What, for instance, does it mean to say that the state "is an earth-bound living organism"? About 1900 Kjellen, a mystical Swedish writer, declared that "Power is the most important attribute of the State." He developed this thesis, and seems to have been the first to use the term *Geopolitik* in this connection.

H. J. Mackinder — the founder of modern geography in England — wrote an article called "The Geographical Pivot of History" in 1904,¹⁰ which had much influence in this particular field of work. It was followed by his book *Democratic Ideals and Reality*,¹¹ which in turn is often quoted as a text by the German school of *Geopolitik*. We shall return to his researches later.

Meanwhile in 1908 Major Karl Haushofer had been sent from Germany to Tokyo by the General Staff to study the training of the Japanese army. Andreas Dorpalen in a recent book *The World of General Haushofer*¹² has given us an account of the young German

⁹An excellent study of the evolution of geopolitics is *Generals and Geographers* by H. W. Weigert, New York, 1942.

¹⁰*Geographical Journal*, London, 1904.

¹¹See the new edition published in New York, 1942.

¹²Andreas Dorpalen, *The World of General Haushofer*, New York, Toronto, 1942.

officer's deductions from his study of military life in Japan. Here Haushofer found a country of rare national unity, where the Japanese was a faithful subject of his god-like emperor, and where the "geopolitical instinct" of the nation gave the government a free hand. No Japanese cabinet, he noted enviously, had to contend with the "geopolitical shortsightedness" of political parties. The government stood above the law, and parliament was a mere sounding-board of public opinion. For years the rulers kept hammering away at the statement that Japan had not enough space to feed her population; and this phrase "became the *leit-motif* of their domestic policy."

When in 1926 the present writer made a rapid survey of Japan he was much puzzled by the large areas of land covered with unproductive cane-grass, etc. Coming from arid Australia it was difficult to understand this waste of well-watered land, especially as there was unlimited labour supply, and in the words of the Japanese "no land to spare." At no time was he able to get a clear answer to his questions on this point. If he had not been a scientist visiting at the government's invitation no such questioning would have been tolerated.

To return to Haushofer. It appeared to him that the Japanese government had been able to rally the nation behind a desirable imperialistic policy on grounds which were in part actually non-existent. Moreover, he was in Japan at the time when Korea was being annexed. Japan's leaders had reached their objectives because they had seen the world political situation as the reflection of geographical, national, racial, religious, and many other factors. After this fashion Haushofer later patterned the German geopolitical school. He returned to Germany, fought in the Great War, and had no doubt as to the deeper causes of the disaster of 1918. "Germany's leaders had stumbled into the war completely unaware of its world-political connotations."¹³

In 1919 Haushofer became Professor of Geography at the University of Munich, and in 1924 he established, with a number of collaborators, the *Zeitschrift für Geopolitik*. Partly as a result of his efforts, when Hitler rose to power a decade later, all Germany was united in its demand for living space (*Lebensraum*). Indeed Hess was a disciple of Haushofer, and so Haushofer early became acquainted with Hitler. A good deal of *Geopolitik* will be found in the pages of *Mein Kampf*, for the parallel between Japanese and Nazi rule is obvious. Haushofer, however, was always a strong supporter of the Russo-German entente.

¹³Dorpalen, *The World of General Haushofer*.

Geopolitics to the Haushofer school has a somewhat mystical role. It may be defined as the *Geography of the State* considered as a necessarily expanding organism. The individual is entirely subordinated to this organic state, which is to be aided in its growth by all the powers of the military and civilian population. All sorts of shibboleths, such as *Herrenvolk*, *Lebensraum*, *Drang nach Osten*, etc., etc., occur frequently in *Geopolitik*; and have little scientific reality or justification when critically examined. It must be remarked that other nations have indulged in similar concepts and phrases: for instance, "Britannia rules the waves" did not apply in 1944 in the China Seas; the term "manifest destiny" has always seemed to the writer a very feeble justification for America's westward expansion, though often invoked by politicians in the past. However, no other nation but Germany has made a special "pseudo-science" of this distorted use of geographical principles. It would seem logical that only a dispassionate and critical student of geography will be capable of exposing the errors of German *Geopolitik*.

A number of English and American geographers, for instance the present writer and Whittlesey of Harvard, have used the terms *geopolitics* and *geopolitical* in an objective, non-imperialistic fashion. Whittlesey seems to mean little but "political geography" when he refers to a subject as *geopolitical*. The present writer has tended to stress the prefix "geo" (i.e., world), and make the term *geopolitics* refer to the geography of a state in terms of its position in the world, i.e., its relative power and status. Thus there are various American meanings assigned to this term, as well as those used by Kjellen and Haushofer.

Under these circumstances it has seemed worth while to suggest a new term *Geopacifics* for the general topic of this book. Its main purpose is to examine the methods in which the progress of civilization has been affected, conditioned, or controlled (whichever shade of meaning is preferred) by the environment. The purpose of this study is not, however, to extend Canada's military power so that we shall take advantage of the ungarded frontier, and annex the rich territories of the United States; nor shall we proceed from conquest to conquest till we own America and then the world! That would be "Canadian *Geopolitik*." No, the purpose of this book is to study the essential facts of the spread of man on the earth, of the differentiation of man into the races, of the rise of various nations, of the growth of villages and cities, all with a view to facilitating the gradual development of a

large number of diverse cultures living side by side in a world at peace. It is a worth-while object, and I hope this book will demonstrate that the modern geographer—especially if he has specialized in cultural geography—is as well equipped as most students to help the good work along in some small degree.

Before considering Mackinder's work, which was in a sense complementary to Mahan's on sea power, it will be well to examine the latter very briefly. A. T. Mahan was an American naval officer who published in 1890 a remarkable study *The Influence of Sea Power upon History, 1660-1783*.¹⁴ Summarizing this, we find that he warns a country with a large commerce not to trust to privateers, but to build up a strong and experienced fleet. This is useful not only to protect the vital commerce of the nation, but must also be used to attack the enemy in his own home waters. Even if inferior in strength a "fleet in being" prevents the enemy from inflicting much damage on commerce, since he is unwilling to divide his navy and so risk defeat. Mahan pointed out that the possession of a strong fleet made it unnecessary for England to maintain a large standing army; and this thesis has been accepted for decades as a major principle of British defence.

Mackinder's important memoir "The Geographical Pivot of History" was published in 1904,¹⁵ and in a sense made clear the principles of the strategy of a great land power, such as Russia. Nazi Germany adopted such principles as seemed likely to advance her attempts to control the Old World. The thesis of Mackinder's contribution to military geography may be summarized in the following phrases which he used in 1919:

Who rules East Europe commands the Heartland;
Who rules the Heartland commands the World-Island;
Who rules the World-Island commands the World.

The areas involved in these terms are charted in Fig. 76.

Mackinder commences his study by showing how the early empire-builders of Europe moved from island to promontory, from promontory to peninsula, and from peninsula to the whole littoral of the Mediterranean. Crete gave way to Macedon, and Greece to Rome. Rome first won the peninsula of Italy, then Spain, then Greece, and finally included all the Mediterranean lands (as we have seen in an earlier

¹⁴Boston, 1890.

¹⁵New edition cited in foot-note 11, *supra*.

chapter). In later centuries Charlemagne and Napoleon conquered vast areas in the centre and west of Europe.

After Trafalgar Britain controlled what Mackinder calls the "World Promontory" extending from Britain to Japan. The Indian Ocean became a closed sea comparable with the Mediterranean of the Roman Empire. In his opinion the next stage for a future "Napoleon" was to control east Europe (Fig. 76), and so gain command of the Heartland of central Asia. The latter area is not to be reached from the sea, and



FIGURE 76.—Areas in the Old World defined by Mackinder in his geopolitical studies.

is largely a land of nomads. The great populations of Eurasia live either to the north-west or to the south-east of the Heartland. They are so concentrated here, that four-fifths of the total population live in two regions which together measure only one-fifth of its area.¹⁶

Mackinder points out that the invasion of Siberia by the Russian Cossacks in the sixteenth century brought in the man power necessary to found a lasting empire in the Heartland. The German and Austrian *Drang nach Osten* was another attempt to control the landways of Anatolia, Iraq, and Iran; probably with a view to dominating the Heartland from the south. In 1919 he wrote: "A great military power in possession of the Heartland and of Arabia could take easy possession

¹⁶See foot-note 11, *supra*.

of the crossways of the world at Suez." Britain has prevented any such design from maturing in the past; but as he goes on to say, "the facts of geography remain, and offer ever-increasing strategical opportunities to land-power as against sea-power."

It is easy to see why these lucid geographical deductions should appeal to the new school of *Geopolitik* founded by Haushofer in 1924.¹⁷ Indeed diagrams such as that reproduced in Fig. 76 were copied several times in the *Zeitschrift für Geopolitik*. It is, of course, the intention behind the publication which is important. Mackinder wanted to guard against Britain relying too exclusively on sea power; no one has ever suggested that Britain has any designs on the Heartland or on world domination. On the other hand, many of the maps and deductions presented in the *Zeitschrift* had no other aim. This became more and more obvious as the German military power increased.

It is not possible in this brief study of *Geopolitik* to give more than one or two examples of the German hopes and aims. A recent book by Derwent Whittlesey, *German Strategy of World Conquest*,¹⁸ gives a full account, and it is written by an American geographer well known for his studies in political geography. I borrow the data for one illustration (Fig. 77) from his book, which data in turn are copied from an unofficial German publication by Otto Richard Tannenberg, *Great Germany, the Work of the 20th Century*.¹⁹ "Tannenberg" is a nom-de-plume for some writer who wished to conceal his identity.

¹⁷The closing years of this famous geographer were filled with tragedy. As the result of Karl Haushofer's obsession with geopolitics of the worst German type, his son Albrecht—also a well-known geographer—turned away from him. The son was involved in the bomb plot against Hitler in July, 1944; and, according to the journal *Time* (March, 1946), was imprisoned and murdered in 1945 after trying to negotiate peace. In March, 1946, Karl Haushofer and his wife committed suicide near Munich. *Time* quotes a poem by the son, which stresses the influence of his father on the evil ideology of the Nazis. It forms a sad epitaph to a career of much value at least in pre-Nazi days.

In father's life, the die is cast.
Once it was in the power of his will
To push the demon back into his cell.
My father held the seal and broke it.
He did not sense the breath of evil
And out into the world he let the devil.

¹⁸New York, Toronto, 1942.

¹⁹Leipzig, 1911.

In general we see that "Tannenberg" believes that there is a place in the world for England as well as for Germany. To placate the English a very large territory is earmarked as a future extension of the British Empire. This is shown in diagonal ruling on Fig. 77. The

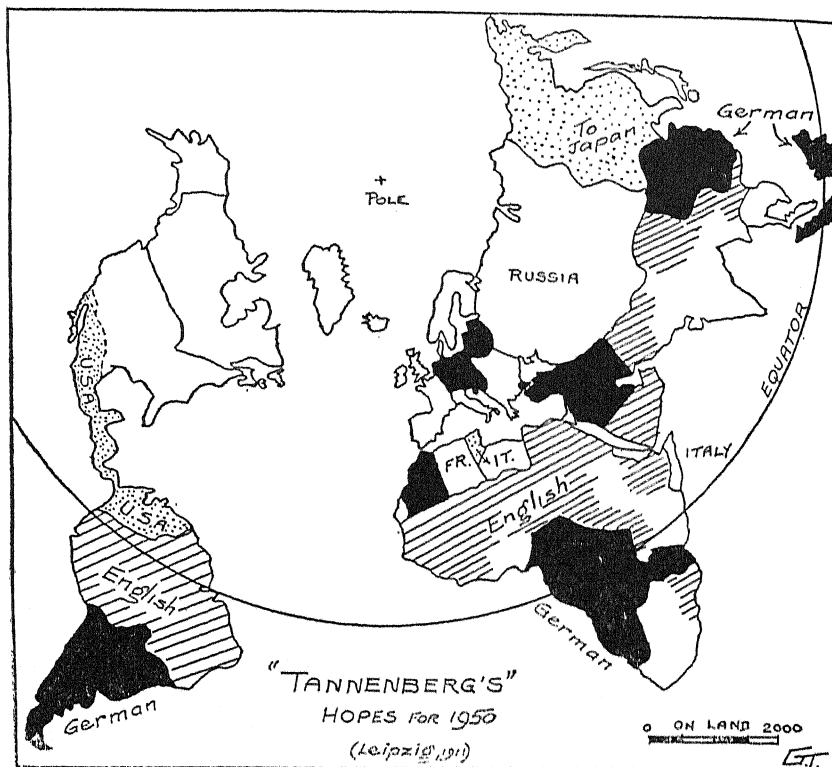


FIGURE 77.—Tannenberg's map of the world, published in 1911, incorporating the hopes of certain German geographers as to future German colonies (black). It was suggested that the lands ruled diagonally should be acquired by England.

proposed German Colonial Empire is shown in black; some of which in Africa was, of course, in 1911 already in German hands.

Perhaps naturally, the lands so kindly taken from the other powers and handed to England were mostly deserts or tropical regions of not much value. Germany, however, was to acquire temperate South America, the best part of China, the pick of north Africa and of west

Africa, the Near East, and the Dutch East Indies. France and Portugal and the Lowlands were to be dispossessed of almost all their colonies, which were to be shared between the Germans and the English for the most part. No consideration was shown for Latin America; and a good deal of the latter was to be handed over to the United States, presumably to gain her acquiescence in the "grab." So also Japan was to be given a large portion of Russian territory in the east of Siberia.

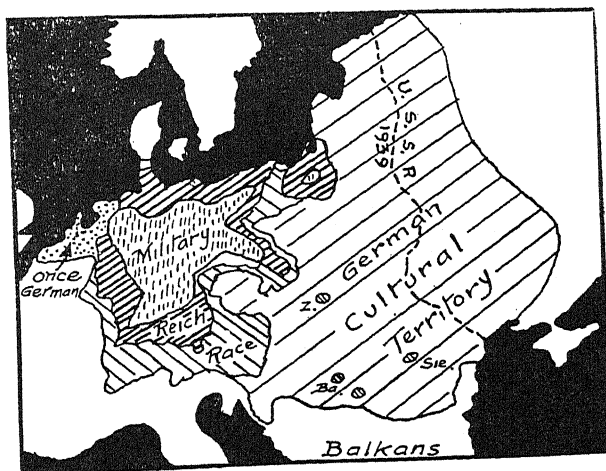


FIGURE 78.—A map of central Europe to show the German Kultur-Boden. Zips, Banat and Siebenbürgen are shown by initials. (From a German Schul-Atlas; with the "Military Area" added from Dorpalen.)

It is instructive to read the discussions with which "Tannenberg" seeks to justify these immense changes in territory; but the reader must turn to the original, or to the full account given in Whittlesey's interesting volume. In fairness to this anonymous German geographer it must be remembered that in the forty years between 1870 and 1910, a good deal of the world had been carved up much in the fashion suggested in Fig. 77. True it had been acquired from relatively uncivilized peoples, whose opinions in the matter were not often considered by the powers concerned. But it seems equally unlikely that Germany would worry about the feelings of France, Portugal, and Latin America in the "grab" suggested in Fig. 77.

The last map dealing with German Geopolitik (Fig. 78) is taken

from the (in many ways) excellent *Methodischer Schul-Atlas*.²⁰ It is much the same as a map given in Dorpalen's book,²¹ and it shows central Europe as it looks to young German eyes. The area is divided into zones, with the "inner stronghold" of Germany in the centre. Outside this is the German Reich of 1918-38. A larger area contains the German "race," which is a misuse of the term (common to all laymen), since it means apparently "speakers of the German language." This zone includes Austria and much of Switzerland. Farther afield are Holland and Belgium, which are close to Germany culturally (in German eyes) because they were once a part of the early Reich, and still speak a Platt-Deutsch in large areas. The chief interest lies in the east, where a vast area is described as German "cultural territory." The main argument apparently for this statement is the fact that German is the chief foreign-trade language in the area. There are, of course, large, quite isolated minorities of German colonists in this region: especially at Zips, Banat, and Siebenbürger; and on the lower Volga above Stalingrad. Most of these are indicated by initials in Fig. 78.

²⁰Published by Justus Perthes, Gotha, 1932.

²¹*The World of General Haushofer*, 1942.

CHAPTER XII

CORRIDORS OF CONQUEST — THE SEVEN SOUTHERN GATES OF EUROPE

THE BUILD OF THE MEDITERRANEAN LANDS

IN this chapter I propose to illustrate still further the importance of the environment as affecting the path of civilization. Since we are still dealing with war, the relation is indirect; but Topographic Control is a very vital branch of Military Geography, which has affected the evolution and status of nations right through history. In this small volume only a brief account of Topography in War can be given; and I propose to confine my discussion almost entirely to the Mediterranean area, which is known to me from a number of journeys, and which was a vital field in the recent war.¹

The famous term "soft under-belly of the Reich" seems rather unfortunately chosen, if it is supposed to suggest the southern border of the German *Festung* (or stronghold). The actual truth is that the Mediterranean Sea on its northern side is bounded by much the most continuous mountain barrier that had to be carefully considered by the Allied leaders. (See Fig. 84.)

This barrier extends for some 2,000 miles; and Ellen Semple pointed out a generation ago that there are only seven major breaks in this enormous barrier, which separates the plains of Germany and steppes of Russia from the sunny peninsulas and headlands which fringe the "Middle Sea." To these topographic breaks the term "Corridors of Conquest" has been aptly applied, since they determined the march of armies in southern and central Europe throughout historic times. (Of course these same corridors have been of major importance in the fields of culture and commerce, as was pointed out earlier, but we are not concerned with those aspects in this chapter.)

Let us first look at the Mediterranean as a regional unit. Fig. 79 shows us that the northern mountain boundary is formed of two more

¹In July, 1942, I published a booklet (Ryerson, Toronto) which described the military geography of the Western Front. See also an article on the same topic "Corridors into Germany" (*The Scientific Monthly*, May, 1945).

or less parallel barriers. These rose out of the former much enlarged Mediterranean Sea (known as the *Tethys* Sea) as they were squeezed between the African shield and the Russian shield (p. 10). The northern wave is called the *Alpides*, because part of it builds up the Alps; and it probably rose like a giant "breaker" and then fell over to the north (see the inset in Fig. 82). It is a legitimate exaggeration to say that the floor of the Mediterranean rose up and very slowly swept over southern Germany and Switzerland. It forms most of the Alps, as stated, but extends westward to the Pyrenees, and perhaps ends near Gibraltar. To the east it builds the Carpathians and the east Balkans. Then it

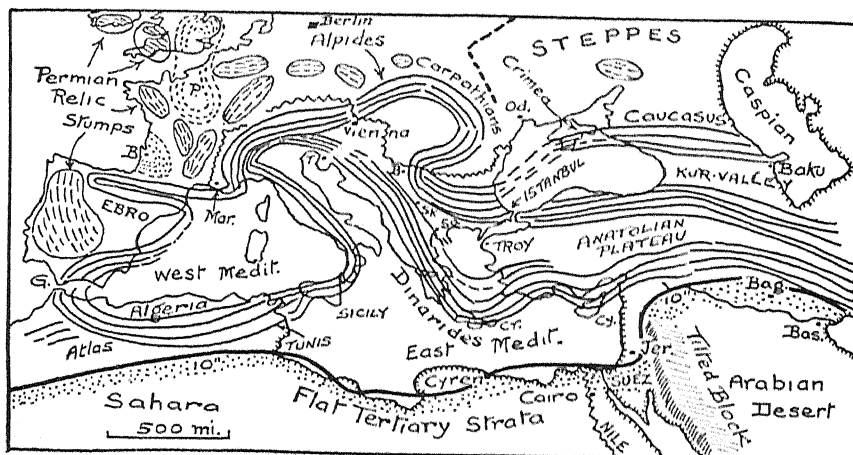


FIGURE 79.—The build of the Mediterranean region, showing the two parallel series of young mountains. Note the 10-inch rain-line bounding the desert lands. P and B are the Paris and Bordeaux basins.

passes into Asia and helps to build the Anatolian plateau. One smaller upfold forms the mountains of the southern Crimea, and directly accounts for the strong naval fortress of Sebastopol. This latter fold, still farther east, forms the range of the Caucasus (*Kavkaz*), in which is Mount Elbruz (18,530 feet) the highest mountain in Europe.

The more southern of the two "earth-waves" is known as the *Dinarides* (Fig. 79). It builds the Dinaric Mountains in Yugo-Slavia along the east side of the Adriatic Sea. It extends east and west in a series of mountain arcs, some of which extend through Greece and cause the "five fingers" which are so conspicuous a feature in the south of that country. Thence the folds pass to the east, and have been

drowned in the later subsidences of the Aegean Sea. The innumerable islands in this sea are the summits of these drowned folds of the Dinarides. To the east the extension of the Dinarides helps to build the great Anatolian plateau. To the west of the Adriatic the Dinarides can be traced along the north side of the Lombard plain; but here they are dwarfed by the northern Alpides. They re-curve to the south-east in the grand sweep of the Apennines, cross Italy, reach Tunis and Algeria; and finally rise to the very high mountains of the Atlas in Morocco, where Mount Tinzar is said to be 15,000 feet high.

This grand upfold of the Dinarides seems to have been overfolded to the south (i.e., in the opposite direction from the Alpides); so that one might state that part of the floor of the Tethys Sea formed a "breaker" flung southward over Africa. In a later sketch (Fig. 81) dealing with the Morava-Vardar Corridor, this concept of the "centrifugal splashing" of the Tethys floor will be made quite clear. I feel that the layman is interested enough in the method by which mountains have been produced to follow this introduction; but it must be allowed that topographic features which originated ten million years ago or more have been greatly altered by erosion since that date. However, it is worth while to realize that the building of the southern wave (i.e., the Dinarides) is still slightly active. We know this from the violent earthquakes of Messina, and Calabria, and from the volcanoes of Vesuvius, Etna, Stromboli, etc., in the vicinity of Sicily, which indicate adjustments in the earth's crust hereabouts. (Fig. 84.)

The reader may well ask: Where is the soft under-belly? One can only answer that the phrase must refer to morale and resources, not to physical approaches. It is, however, worth noting that there is a great difference between the northern and southern coasts of the eastern Mediterranean. From Tunis to the east as far as northern Palestine, there is a totally different type of coast from all the rest of the Mediterranean. No crustal "breakers" affected Libya, Egypt, and Palestine. Here if you like is a soft under-belly, but it is of little importance in the broadest sense, since the hinterland is desert. The position of the 10-inch rain-line is inserted in Fig. 79; and this shows us how little value there is in Italian Libya as a field of colonization. It is little better than an "Egypt without a Nile." Only near Tripoli and Cyrene (Benghazi, etc.) is the rain over 10 inches a year, so that crops of barley, etc., can be grown in favourable districts.

Along this coast the formations are level-bedded Tertiary sandstones, shales, and limestones for the most part. They cover the African shield, and present low scarps to the Mediterranean Sea. In a later paragraph some discussion will be given regarding the topography here. It has been stated that the fate of the British Empire depended on the great Qattara Depression near Cairo (Fig. 86), which made possible the stand of the British during 1942 at this point.

It may well be asked, "What caused the young mountain folds to take on the characteristic arcuate shapes?" In many cases it seems to be due to the fact that the crust contains *resistant masses* surrounded by more "pliable" formations. Thus in Spain we see that the Sierra Nevada in the south-east and the Pyrenees in the north-east seem to be squeezed round the margins of the resistant mass of west Spain. This latter is, of course, a relic stump of a long-vanished mountain range of 150 million years ago (p. 18). Sardinia is another such resistant mass. It is generally accepted that the other arcs, such as that of the Carpathians, are folded around rather deeply buried resistant masses. One such is supposed to be under the Hungarian plain, another under the Lombard plain, and a third under the lower Danube as it flows over the plains of eastern Roumania. Indeed it is rather easier to account for the high "young mountains," than to explain how the great enclosed *plains* escaped from being involved in the extensive crustal folding. (See the Frontispiece.)

To the north and north-west of the Alps an extensive series of relic stumps is sketched on Fig. 79. These have been fairly fully discussed in an earlier section dealing with the build of Germany (p. 177). It is, however, clear to the geographer that the best time to attack the German territory *from the south* was before the great Alpine Storm occurred! At that time there was no Alpine barrier, and the relic stumps were probably lower than they are now. However, this is mere academic persiflage, since that happy time, when there really was a soft under-belly to the region, was about twenty million years ago!

It is worth spending a few minutes to consider the different effect which these two types of mountains have had upon human affairs. The worn-down relic stumps (derived, of course, from young mountains) which form a series across western and central Europe (Fig. 79), are not usually high enough or rugged enough to sever cultures, but have often been fairly habitable, and indeed have acted as refuges for primitive

cultures. This is particularly true in the case of the Roumanian plateaux forming the southern end of the Carpathians. Other similar results of the topography are suggested in the following table.

TOPOGRAPHIC CONTROL BY RELIC STUMPS (OLD MOUNTAINS)

Region	Elevation	Some Historical Aspects
Spanish Meseta.....	2,000 feet	Unusually dry. Splits the national stocks.
Brittany.....	500 "	Helped to maintain Breton culture and Alpine race.
Cevennes.....	3,000 "	Tip of Alpine race, focus of revolt, Albi, etc.
Ardennes.....	10,000 "	Deflects trade and war into the Brabant Corridor.
Bohemia.....	2,000 "	Main factor in maintaining Czech culture.
Sardinia.....	1,500 "	Rugged island, preserves simplest Mediterranean
South Carpathians..	5,000 "	Preserved Roumanian culture in past. [culture.

We may now contrast the life in the young mountains, which in general is naturally very sparse and mainly confined to the shepherd type. However, the lower slopes of these much higher, rugged areas naturally have also acted as a refuges for broken nations in the past.

TOPOGRAPHIC CONTROL BY YOUNG MOUNTAINS

Region	Elevation	Some Historical Aspects
Sierra Nevada.....	9,000 feet	Marginal, but refuge for Moors.
Pyrenees.....	8,000 "	Separate the French and Spanish cultures.
West Alps.....	9,000 "	Separate French and German from Spanish culture.
East Alps.....	8,000 "	Bound the Italian culture. German in some valleys.
Apennines.....	4,000 "	Helped to delay Italian unity.
Dinarics.....	5,000 "	Conserved Montenegrin and Albanian cultures.
North Carpathians	4,000 "	Conserved Slovak and Ruthenian cultures.

It is worth noting that the mineral contents of the relic blocks are much more valuable as a rule than those in the young mountains. The deposits in the latter have in general only lately been elevated above the sea, and were formerly the not very old rocks of the floor of the Tethys Sea. The relic stumps have been worn down to the most ancient rocks long ago, and so they often contain ores of value. The first large-scale mining in Europe was in the ores of the Erzgebirge (Ore Mountains) of the Bohemian relic blocks. Spain on the whole is the western country richest in metals, and this is due to the copper, lead, zinc, iron, and mercury associated with the old rocks of the Meseta. In Russia the ores of the Urals—an uplifted relic block—are

far richer than those in the Alps, which are young mountains with much of the upper "metal-free" strata still not eroded.

THE SEVEN CORRIDORS THROUGH THE NORTHERN BARRIER

(1) *Istanbul*

A survey of the great European barrier, thrown up some ten million years ago in the Alpine Storm, shows that there are seven noteworthy gaps linking the cool, wet, forested, northern environments with the hot, dry-summer, regions of the Mediterranean. There is, of course, a geological reason for each of these depressions, which is worthy of mention. One of these gaps—linking the Dardanelles and Bosphorus—is below sea level; and hence throughout early European history, it was by far the most important corridor of commerce. It is due to the faulting of the crust during the period when the Black Sea and the Aegean Sea subsided as vast *graben* (i.e., down-dropped earth blocks). This corridor led to the growth of Troy at the south-west end, and of the city of Byzantium at the north-east end of the waterway.

To Europe as a whole Byzantium (the early name of Istanbul) was probably a more vital centre of culture than Rome itself. It lay on the only easy land route linking "new" Europe with "old" Asia. Here again, all the commerce of a thousand centres on the Danube, Don, Dniester, Dnieper—not to mention the southern coasts of the Black Sea—was funnelled into a narrow corridor, and then reached the equally important trade area of the Aegean and the Mediterranean. The textiles, wines, and metals of the progressive south were exchanged for the hides, fish, fur, slaves, etc., of the "backwoodsmen" who lived to the north of the Byzantine gate.

Later, as the Roman Empire became the dominant force in civilization in this part of the world, Constantine moved the centre of the Empire to Byzantium in A.D. 330. He gave it his own name, only recently replaced by *Istanbul*. Here was a commercial centre more important than Rome. Here he could watch the most dangerous boundary of his Empire, which lay to the south-east fronting the Parthians, rather than to the south-west as in the days of Carthage. Here also the new religion of Christianity—which he had espoused—would have a fresher soil than in the old centre of the Empire at Rome. Perhaps also he wished to be free from the legends of republican Rome, and institute a more despotic rule in the new city in the east.

As everyone knows, Rome lost her powers in the fifth century, and "fell" under the onslaughts of various northern invaders, not once but on several occasions. Finally the Ostrogoths took over the government, to be followed by the Lombards; and now the relics of the Roman Empire were completely centred on Constantinople. Here the Roman tradition persisted for a thousand years, though it is well to remember it was a Roman culture covered by a stratum of Greek ways and customs.

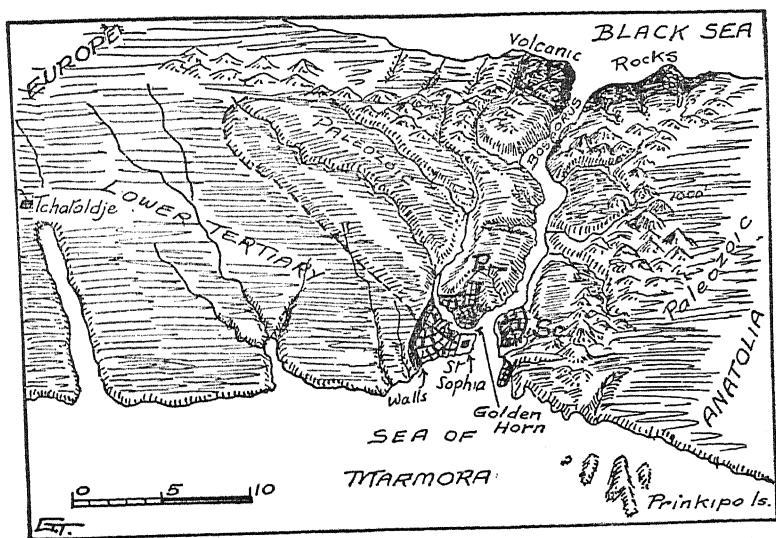


FIGURE 80.—A sketch plan of the Bosphorus at Constantinople (Istanbul)—the chief corridor across the Alpine folds of Europe. The city is enclosed by a wall on the west. Across the Golden Horn is Pera (P), and to the east Scutari (Sc).

Constantinople beat back the Goths in A.D. 378, after the terrible Roman defeat at Adrianople. The walls shown in the sketch (Fig. 80) were built in 413, and saved the city from the Avars, Bulgarians, Saracens, Crusaders, and Turks (in 1422). The city was, of course, finally captured in 1453. As far as European civilization is concerned we must remember that this corridor was a "way of light" for eastern Europe much as the Rhone Way was a "way of light" for France and England. From New Rome, as the city was often termed, spread the Christian faith to the Bulgarians, South Slavs, and Russians. There is little need to emphasize further the importance of this Byzantine corridor.

The sketch in Fig. 80 shows the appearance of this famous sea-level route of the Bosphorus. It is about twenty miles long, and is a very narrow deep passage often only a mile wide. The cliffs are several hundred feet high at the northern end, where hard igneous rocks have been affected by the depression. Most of the passage is cut in Paleozoic (Devonian) rocks, which extend far to the west, as indicated. The land is highest near the east shore, where it rises to about 1,000 feet. It falls fairly gradually to the west, and is much lower in the young rocks near the famous military lines of Tchataldje. The lower portion of a narrow tributary river valley has been drowned by the sea to form the famous "Golden Horn." This joins the Bosphorus just at its south-west end, and formed a deep safe harbour for the vessels of medieval times (Fig. 80). The sultan's palace was just south of the Horn in the shadow of the famous church of St. Sophia. Across the Horn to the north is the residential suburb of Pera (P in the sketch), while Scutari is to the east on the Asiatic side of the Bosphorus (Sc in the sketch). Here starts the modern railway to Ankara and Baghdad.

In Bowman's words: "It was jealousy among the Great Powers that kept the Turk so long in Constantinople. No power wanted to see another in possession of the strategic gateway of the Bosphorus."² To the Russians the outlet was more attractive than Leningrad, and they have striven through the centuries to capture this open-water port, nearly gaining their desires in 1878 and 1914. Today the Suez Canal has robbed it of some of its former dominance. The whole region near the city is demilitarized, and all shipping can pass freely in peace-time. Today the mile-wide Bosphorus is far less of a military obstacle than it was throughout the Middle Ages, but Istanbul still controls one of the most strategic positions in Europe or Asia.

(2 and 3) *The Morava-Vardar and Peartree Corridors in the Balkans*

The next two major gates across the mountain barrier are of much less historical importance, but are of great military significance even today. They have always been the main corridors from the north to the Aegean and Adriatic Seas respectively. The first which we have to consider links together and determines the importance of the famous towns of Belgrade and Salonika. It is usually named the Morava-Vardar Corridor, from the two rivers which flow along the corridor. It

²The New World, New York, 1928, p. 517.

is far longer than the Bosphorus Corridor, being some 300 miles from north to south. Moreover, it has always been a rather difficult route; partly because it is rather narrow and rugged, and partly because it passes through rather poor districts inhabited by unprogressive peoples. Banditry has been rife in the mountains on each flank right up to modern times; and the region was held back from normal progress by the long period of Turkish misrule.

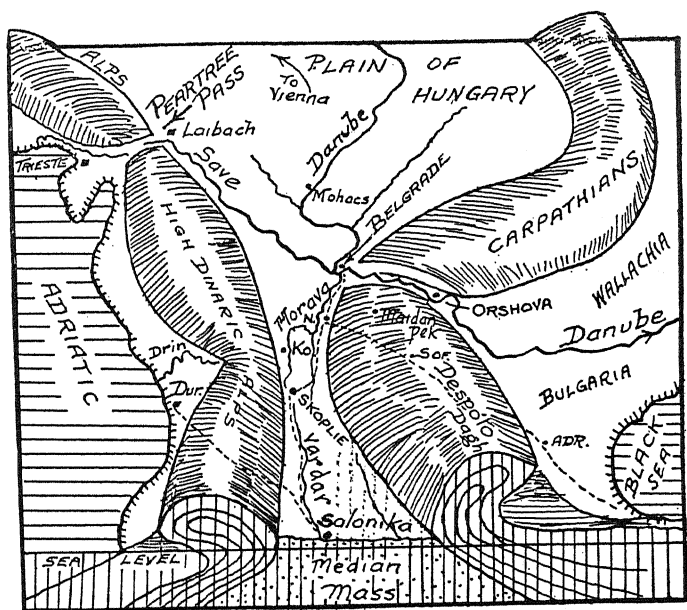


FIGURE 81.—A very much generalized diagram to show the main features of the two main corridors of the Balkans—the Morava-Vardar and Peartree routes. The front edge shows the folds in vertical section.

What has determined the presence of this long corridor right through the Balkans? As usual the structure of the country gives us the clue, and also explains much of the general environment. In Fig. 81 is a very much generalized diagram of this region, showing a rough geological section in the front of the diagram. We are dealing with the two parallel folds of the young mountains discussed previously. The Dinarides fringe the Adriatic, while the extension of the Alpides (Despoto Dag) fringes the east side of the corridor.

When the weak sediments of the ancient Tethys Sea were upfolded into ridges by being squeezed between the Russian and African shields, there was a resistant "median mass" included in the softer sediments between the two upfolds. This "indigestible" block of granite, etc., caused the rising folds to "break" over, away from the median mass, as suggested in the front of the diagram. The median mass preserved a fairly wide flattish area between the two folds; though needless to say it was not anything like so flat or simple as shown in the diagram. In this central resistant mass, which was not raised, the rivers of the region naturally took their way: the Morava flowing north to the Danube, and the Vardar south to the Aegean Sea near Salonika. At the divide at the head of both is the little town of Uskub (Skoplic), which has always been a position of great military importance in the Balkans.

The Dinaric ranges are high and bare, and consist of many north-south ridges. As a consequence there is no easy route from the Adriatic up to the corridor we are considering. The old *Via Egnatia* of Roman times ran from Durazzo to Salonika, and is perhaps the chief mountain route across the barrier. It is shown as a broken line in Fig. 81. So also there is a route, and a much more practicable one, across the north of the Despoto Dag. It connects Nish (near Belgrade) with Adrianople, by way of the capital of Bulgaria at Sofia. The Dragoman Pass near Nish carries this road over the young mountains at a height of about 2,500 feet. The divide at Skoplic is only 1,300 feet above sea level, so that this has been the main path of migrations and invasions right through the history of the Balkans. (The author spent several years of his boyhood at the north end of this corridor, and on his last visit experienced one of his rather numerous arrests as a spy!)

We can only devote a paragraph or two to the importance of this corridor in European history. Along the Morava-Vardar valley came the Dorians and early settlers of Greece, who later built up the civilization upon which our philosophy and science are founded. From the cold north came the Slav tribes of the fifth and sixth centuries by way of this corridor. Many were incorporated in the Greek nation, others helped to build the Bulgarians and Macedonians. Here the valiant Serbs defied the Turks, and in a vain defence of this vital artery of their nation suffered the disastrous defeat of Kossova (Ko.) in 1389.

Belgrade, though not quite at the mouth of the Morava, holds the key to this corridor in the north. It also commands the Danube gorge near Orshova, and is not far from the Bulgarian road at Nish. Just to

the north of the corridor on the road to Vienna is the town of Mohacs (Mohatch); where the whole of the Hungarian aristocracy (including King Louis) died in a fierce battle against the Turks in 1526. Once more Christians and Moslems met here in battle in 1687, but this time the Turks were sent reeling to the south, and never again menaced the Hungarian plains. In conclusion it must be remembered that the "Alpides" have yet to be passed (by armies moving north from the Hungarian plain) before the northern plains of Europe can be reached. Vienna holds this northern gate, whether the traveller goes west to Munich or north to Silesia. Hence neither the Morava-Vardar Corridor, nor the one now to be considered (the Peartree Pass) traverses the whole of the mountain barrier.

At the head of the Adriatic Sea is the port of Trieste, and behind this well-known city is one of the few gaps in the barrier (Fig. 81). It seems to be due to the Dinarides sinking nearly to sea level hereabouts, and passing to the west as relatively low ridges bounding the north of the Lombard plain. The Alpides on the whole curve to the north-east on this side of the Hungarian plain, and join the Carpathian arcs at Vienna (see Fig. 79). At any rate here is our third gateway; and it links the Adriatic directly with the Danube basin by way of Laibach. The origin of the term "Peartree" is unknown to me; but the undulating limestone hills and dales between Laibach and Trieste, with numerous forests and queer circular depressions (*dolines*) afford a more attractive landscape than the bare mountains to the south, or the jagged but better clothed Julian Alps to the north.³ In this corridor is Zirknitz which receives the greatest rainfall of any place on the continent (Fig. 5). The divide on this pass is about 2,900 feet; so that it is much higher than the Skoplie divide. On the other hand it is far lower than the Brenner Pass (4,470 feet), which is the main pass of the Alps proper.

As I have written elsewhere, "down the Peartree Pass poured the barbarians, eager to ravage the rich lands of Italy. It was used by the Cimbri in the centuries before Christ. Theodosius of the Eastern Empire advanced to attack Rome by this route at the close of the fourth century A.D. The Visigoths, the Huns, and the Ostrogoths all used it; and in 600 it saw the Avars and later the Magyars. Indeed the

³For a description of my survey see the article "Cultural Geography of Yugo-Slavia" (*Canadian Geographical Journal*, Jan., 1940).

March of Istria was established by the Holy Roman Empire specifically to hold back barbarian invaders during the ninth and tenth centuries." In later times its importance dwindled, partly because its hinterland was held for centuries by the ignorant and unprogressive Turk. It was this gap, of course, which helped to tie the Croats to the Roman culture, while the Serbs (living in the Morava-Vardar Corridor) became attached to the Greek Orthodox religion of Constantinople. In the First Great War the Italians and Austrians fought for years in this gateway, without either gaining control of the only wide corridor whereby the eastern flanks of the Alps may be turned. As I write (in the critical month of July, 1943) I wonder if we shall see Hitler trying to stem the Allies in an invasion of Austria from the Adriatic by way of the Peartree Pass.

(4) *The Major Barrier of the Alps: The Brenner and Reschen Passes*

I shall always be glad that my introduction to the most interesting landscapes in the world—the Swiss Alps—came from that past master in topography, William Morris Davis of Harvard. In 1908 when I was a research student at Cambridge, he invited me to join his summer expedition to the glacial valleys of the Alps. We surveyed the Como, Ivrea, and Grenoble areas under his direction; and from that day to this I have been deeply interested in topographic control, and have managed to do some research thereon in each of the seven continents.

Most laymen have quite a wrong idea of this Alpine barrier, because sketches and models rarely give us a true idea of the proportions of the mountain zone. In the map in Fig. 82 I give enough data for the reader to obtain a true picture of this part of Europe. The area over 3,000 feet is shown dotted, and this has an outline which reminds one strongly of a "lobster," with the head to the right. Suppose we consider the Alps in the vicinity of the Brenner Pass—where the mountains are at their widest. The barrier is 120 miles from north to south, so that the Brenner route is a long and tedious journey, as one leaves the lowlands of Bavaria near Munich, and crosses the Alps to reach Venice or Rome. The average height of the Alps is about five or six thousand feet; let us say one mile high. Thus to true scale a section of the Alps would be 120 times as long as it is high. Let the reader try to draw such a section. I have done this exercise myself, and the result is the thin line (between the arrows) given in the top left corner of Fig. 82.

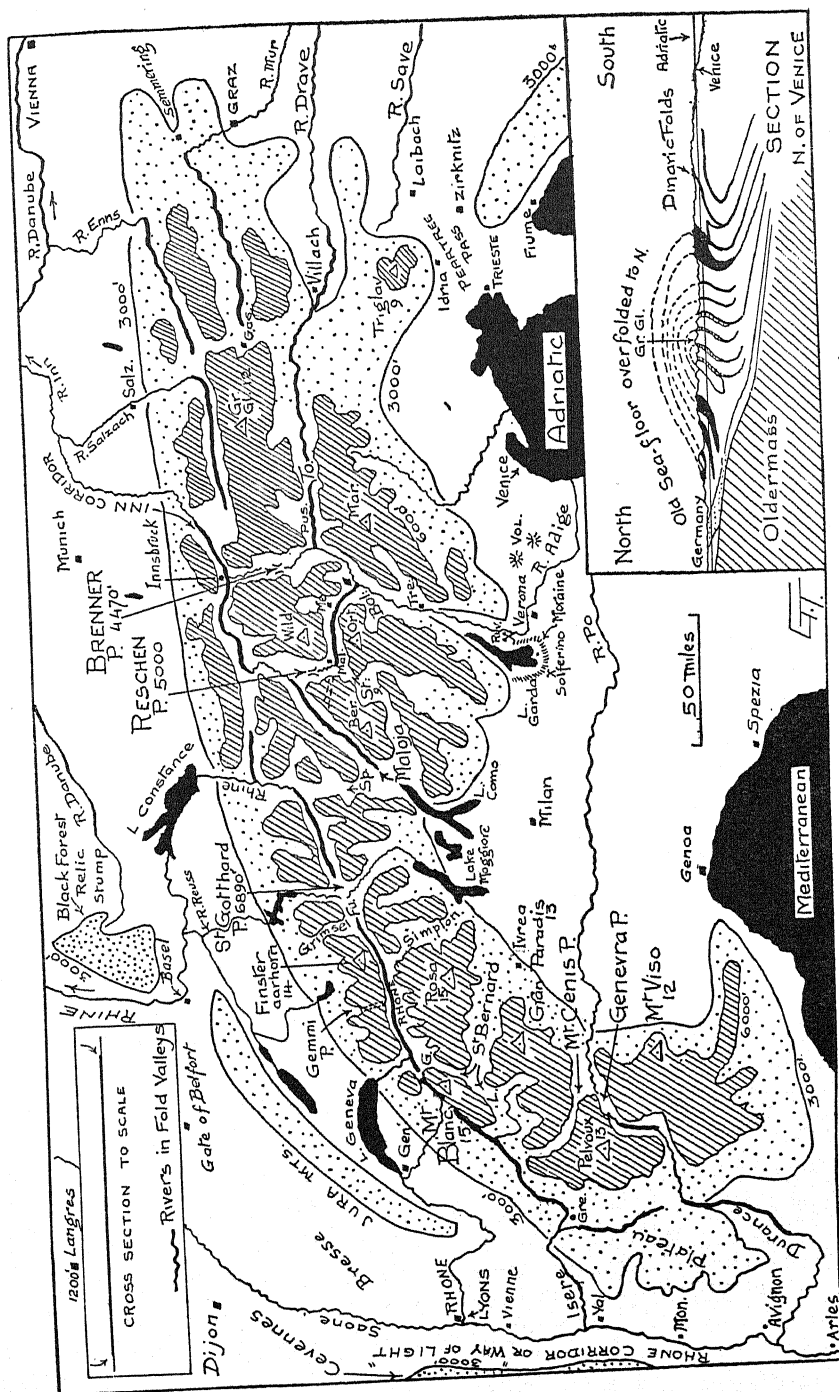


FIGURE 82.—The topography of the Alps, shown by the 3,000-foot and 6,000-foot contours. The Longitudinal valleys are shown by heavy wavy lines. Inset is a vertical section across the Alps from Venice to Munich, showing the old sea floor flung over as a "breaker" to the north.

In the section across the Alps through Gross Glockner (in the lower inset) the vertical scale is exaggerated about three times.

Hence, though the Alps form a great barrier to bipeds whose lot it is to travel slowly over the earth's surface, they are little of an obstacle in these days of air travel. However, I do not propose to dwell on the way in which a great barrier has dwindled in importance in the last twenty years; but I wish to draw the reader's attention to certain structural features which have greatly affected travel all through the historic periods.

From what I have written already, the reader should be able to understand the vertical section through the Alps given in the lower inset (Fig. 82). This shows the weak sediments of the Tethys Sea flung as breakers to the north over Germany. Hard and soft rocks are involved in these crustal folds, and of course they tend to be eroded differently by the rain, rivers, wind, etc., in the millions of years since they were upfolded. In general the axis of the folds runs from west to east; so that the edges of the hard and soft layers appear as ridges and valleys with the same direction. Many of the major valleys in the Alps seem to be derived largely from the original west-east folds. These are called *longitudinal* valleys, and they are naturally occupied in part by the main rivers. I have emphasized these fold-valleys in the map. The upper Rhone and the upper Rhine both flow along such longitudinal valleys. There is a whole series in the north-east used in part by the Inn, Salzach, and Enns Rivers. Further to the south is the remarkable divide at the head of the Drave River near Toblach (To.). Here is what is called a "valley divide," where one can cross to the headwaters of the Pustertal (whose drainage flows to the east) without passing over any notable barrier. There is one huge wide glacial trough running west-east through Toblach, though from here the rivers flow in different directions. The Maloja Pass at the head of the Inn River is somewhat of the same type, though here a considerable drop to the Italian stream is experienced. Another example is the Reschen Pass (Fig. 83).

In general the drainage of a mountain ridge is down slope, i.e., at right angles to the axis of the ridge. Such streams are called *transverse* rivers. Most of the longer rivers in the region of the Alps exhibit sections of each type. Thus the Rhone is longitudinal below the Furka Pass (Fu.) to Martigny, then it turns to the north-west and flows in a somewhat narrower transverse valley till it reaches the Lake of Geneva (Fig. 82).

The best way to think of the Alps is that it is a high-level plane surface about a mile above sea level, in which deep grooves have been eroded by water and ice. Only in these "grooves" is communication at all easy, and only here does any notable population dwell. These grooves (or main valleys) break the Alps into about twenty irregular areas, which are ruled in the map (Fig. 82). In most cases the chief peak in each such area is named. What are the main corridors across this barrier; i.e., which are the chief erosion "grooves"? We can only describe in some detail one of these corridors, that leading to the most famous pass of all, i.e., the Brenner Pass. But it will be of interest first of all to compare the heights of the other major passes.

Traversing the Alps from west to east we reach the passes in the following order: Genevra (6,100 feet above sea level); Cenis (6,800); Little St. Bernard (7,060); Great St. Bernard (8,120); Simplon (6,600); St. Gotthard (6,890); Splügen (6,950); Maloja (5,940); Stelvio (9,005); Reschen (5,000); Brenner (4,470); Pustertal (not across the Alps, 4,000); Peartree (2,900). The superior attractions of the Brenner Pass are evident from this list, though the Reschen runs it close.

In 1938 I made a lengthy study of the relative merits of the Reschen and Brenner Passes, and these may be referred to very briefly. Both cross the main divide well below the tree line, whereas all the other passes are very much higher; usually above the level where even grass will grow well. The Reschen Pass is actually more level than the Brenner at the divide (Fig. 83), and is situated at the bottom of a "glacial trough" with cliffs several thousand feet high. But the major difference is found just north of the pass. In the Brenner a giant glacier of the past has cut out a wide gorge between the Brenner Pass and Innsbruck (Fig. 82); but no such erosion helped the Inn valley north of the Reschen Pass. The valley as cut by the river Inn was so deep, narrow, and difficult, that a good road has only been made north of the Reschen Pass in the last twenty years or so. For the same reason the Maloja Pass was not readily reached from Innsbruck until modern times, and all important traffic over the Alps used the better Brenner route.

The general character of any of these great Alpine corridors can be gathered from a description of one of them. It is based on a survey I made in 1938⁴ extending from Trento (Tre. in Fig. 82) for eighty

⁴"Trento to the Reschen Pass" (*Geographical Review*, April, 1940).

miles north to the Reschen Pass. At the southern end of the Adige Corridor, which leads to the Reschen Pass, is Lake Garda. The floor of this lake is 1,700 feet below sea level; indicating that the lake has been gouged out by glacier ice, since rivers cannot erode below sea level. The southern shore of the lake is bordered by a wide and high crescent of glacial moraines. These hills at the opening into the Brenner corridor have been the scenes of many battles. Napoleon won two of his victories here at Rivoli and Castiglione. Later the Austrians guarded the gateway with their famous quadrilateral, i.e., the four fortresses of Mantua, Verona, Peschiera and Legnano. The battle of Solferino (1859) also shows the strategic importance of this gate.

It will be noticed on the map (Fig. 82) that the Adige flows in a deep valley about eight miles to the east of Lake Garda. This illustrates the fact that great glaciers—such as those which flowed out from the Alps—frequently split into several branches or “fingers.” These branches could and did rise over low ridges, and proceed south to the plains beyond. When the glacier vanished each river occupied the lowest valley with an outlet. So the river Adige (pronounced nearly “Adger”) uses the famous defile of Rivoli rather than the moraine-dammed valley of Lake Garda.

In the forty miles above Rivoli the glacial trough of the Adige only rises about 200 feet. The cross-section is much the same all the way. There is a flat floor across which the large river winds from side to side. This plain is less than a mile wide, and the small towns and villages are built on the drier slopes. On each side the slopes rise rapidly to 3,000 feet in parallel ridges, so that this part of the corridor is easy to defend. At Rovereto a cross valley—cut out by an ice “finger” of the glacier—leads to Arco at the head of Lake Garda. Near here at Beseno is another defile in the trough, where defence is easy; and then the straight deep trough continues to Trento.

Trento is the old capital of the Tridentino tribe, hence the name “Trentino” for all this region (Fig. 82). The town was owned by the Catholic Church from 1027 to 1803; and most of the Trentino came under the Italian rule only as the result of the Great War in 1919. A famous castle blocks the corridor here, which is still in use; and in one of the large churches took place the Council of Trent (1545-63). An important side valley, deepened by glaciers and much used for traffic, enters from the Val Sugana just east of Trento.

The corridor broadens as we travel north of Trento, and at places the floor is two miles wide. It is cultivated for vines and maize chiefly, with many apple and pear orchards, while tomatoes and allied vegetables flourish underneath the trees. Near Salorno the glacial trough narrows, with vertical granite cliffs at each side. Here it was suggested that the Austrian-Italian boundary should be drawn in 1918. It is easily defensible, and is the cultural boundary between the Austrians of the Trentino and the Italians to the south. However the Italians insisted on holding the Brenner Pass, thereby forcing a quarter of a million Austrians to live under a hated flag.

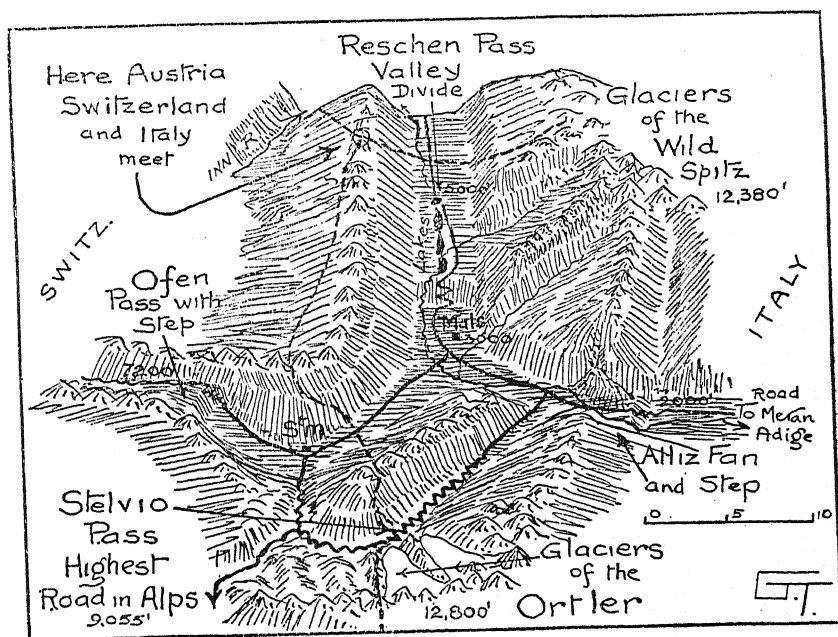


FIGURE 83.—Sketch of the upper portion of the Adige Corridor from Italy to Austria. It shows the different characters of the Reschen, Stelvio, and Ofen Passes.

At Bolzano (Botzen) the route to the Brenner passes up the tributary valley of the Isarco. We turn to the north-west along the main glacial trough of the Adige for sixteen miles, and so reach Meran at 1,045 feet above sea level (Fig. 82). About a dozen miles to the west there is a marked change in the environment. The river descends 1,000 feet in

this short distance from Naturno, and as we rise above the latter place we leave behind the vineyards and maize, and reach a less fertile, but even broader valley, with apples and barley and much uncultivated ground used for pasture. A huge alluvial fan, from streams on the north side, has nearly blocked the main valley at Alliz (Fig. 83). At Mals the railway ends, and here autobuses take one north to the Reschen Pass, south to the Stelvio summit, or west to the Ofen Pass, and so into Switzerland.

North of Malles (Mals) is another of the characteristic steps in the valley floor, amounting to some 1,200 feet. It leads us up to three pretty little lakes occupying most of the flat floor; and so by a very gentle rise to the Reschen Pass itself. Here only a few acres of hardy grain are grown, and timber and pastures clothe the less steep slopes of the stupendous mountains on each side. To the south appears the glacier-capped ridge of the Ortler Range (Ort. in Fig. 82); and to the east, not visible from the pass, is Wildspitz. Each of these peaks is over 12,000 feet in height.

As was stated earlier, the flattish summit at the Reschen Pass is quite unusual, as is its low level of 5,000 feet. If we take either of the other routes from Malles (Mals) we reach more normal Alpine passes (Fig. 83). The Ofen Pass is 7,200 feet above the sea. At first the road traverses a broad glacial trough like that at the Reschen Pass, but in the last mile or two it climbs 500 feet by a number of steep zigzags to reach the divide. The road to the south over the Stelvio Pass (St. in Fig. 82) is probably the most remarkable in the Alps. From Trafoi (4,500 feet) it climbs by a score of hairpin bends to the summit of the pass at 9,055 feet. This is only three and a half miles in a direct line from Trafoi. All the trees are left behind at 7,000 feet, and the ice of the Ortler glaciers reaches almost to the level of the pass (Fig. 83).⁵

The history of the Alps is the history of Switzerland and of the neighbouring nations, and would be out of place here. The Brenner was known as the Emperor's Route, since it was crossed by the Holy Roman

⁵The writer made a study of the characteristic "steps and defiles" of the trough-valley leading south from the St. Gotthard Pass in 1910, in preparation for his studies of glacial topography in the Antarctic. It was exceedingly interesting to find similar "steps and defiles" in the Taylor Valley (seventy miles W.S.W. of Mt. Erebus); and the similarities between the former ice-age valleys in the Alps and actual ice-age valleys in the Antarctic are described in popular language in his book *With Scott — The Silver Lining*, London, 1916.

Emperors some sixty-six times between 793 and 1402. A good carriage road was built in 1772, about fifty years before the St. Gotthard received the same attention. The important railway crossed the Brenner Pass in 1867, and is built on the surface; while the great tunnel under the St. Gotthard Pass was not completed till 1880. There are only a few railways crossing the Alps, the others being the Mont Cenis, linking France and Italy; and, latest of all, the Loetschberg-Simplon railway (in part under the Gemmi Pass) which is the most extensive tunnelling operation known. In Austria, beside the Brenner, there is a less important railway via Gastein. It was the command of the Simplon and St. Gotthard tunnels by the Swiss, which largely prevented Hitler from attacking Switzerland. These tunnels controlled a large portion of the vital trade with Hitler's Italian satellite.

(5) *The Rhone Corridor—The Way of Light*

We have now considered all the corridors of the Alps and of the barrier as far east as the Black Sea. A glance at Fig. 82 will show the importance of the Peartree Pass at the eastern end of the Alps proper; and the map extends far enough to the west to include the main features of the Rhone Corridor. This extends from the Mediterranean Sea north as far as the little town of Langres, which is charted in the extreme upper left corner of the map. This is a distance of 300 miles, all of which is below 1,200 feet; indeed the actual divide at the north of the corridor is only a little higher, and leads us down to the easy country of the Paris basin. Thus the Rhone gate is by far the most important gap in the whole barrier from Gibraltar to the Bosphorus, and has been a line of migration and invasion for tribes and armies from prehistoric times. Long before any but the wildest tribes lived in the Alps and used the Alpine passes, there were settled folk in the Rhone Corridor. It is so wide and open to the beneficial climate of the south that it is sometimes spoken of as an extension of the Mediterranean environment reaching as far north as Dijon.

Parallel to the Rhone Corridor and somewhat to the north-east is the Rhine Corridor (Fig. 84). Both have the same north-south direction, and are due to the same causes. They are depressions in the crust bounded by faults (crustal cracks) and are known as *graben*—a word akin to "grave." During the Alpine Storm the weak formations involved in the Alpine overfolds were thrust over to the north-west into the

gap between the Black Forest relic stump and the similar Cevennes relic stump. Thus were formed the beautiful earthfolds of the Jura Mountains (Fig. 79), while the stiffer formations to the south-west and north-west foundered in two long depressions, i.e., the Rhone and Rhine graben. For a time an arm of the Mediterranean extended north to Geneva, and later a great lake filled the Rhone Corridor. This actually drained into the Rhine graben for a time until earth movements deflected the waters southward.

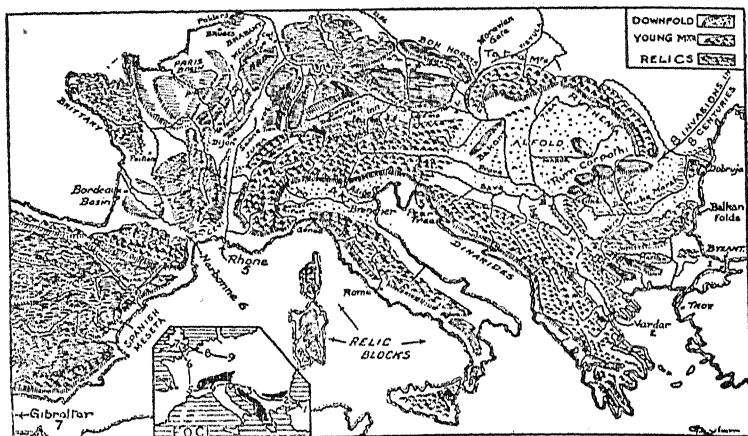


FIGURE 84.—Block diagram of the topographic units in southern Europe. Inset is a map showing the corridors used by movements of culture between foci during the Roman Empire and later. (Young folds are black.)

The silts from this marine gulf and from the large lake are still preserved on the flanks of the Rhone Corridor, and form good soils for the rich vineyards and agriculture of this favoured part of France. At the north end the corridor leads by Dijon and Langres to Paris, and by the Belfort (or Burgundy) Gate to the Rhine graben and to Switzerland. Along the western edge of the Rhone Corridor the Cevennes relic stump rises fairly steeply in a more or less continuous wall to heights of 5,000 feet in places. The eastern boundary is formed of several limestone plateaux, which are separated from the major Alpine folds by a series of north-south longitudinal valleys. These have been cut by rivers and glaciers in a belt of rather softer rocks, and are shown in Fig. 82 extending from Mont Blanc to the river Durance.

In detail the Rhone Corridor consists of a number of wider plains separated by very low, sometimes buried, rocky spurs of adjacent mountains. In the north is the plain of Bresse (Fig. 82) near the town of Macon; and this extends south to Lyons. To the south are similar plains near Vienne and Valence. Just below Montelimar one of the low barriers narrows the valley; and south of this we enter the wide plain of Provence. After passing Orange and Avignon we reach the gravel-covered plains of the Crau. Here is a large olive industry, and the most interesting city is Arles (Fig. 82). In Roman times it was the chief port of the Rhone Corridor, though over twenty miles from the sea. Here a great bridge crossed the river, and carried the *Via Aurelia* which connected Rome with Cadiz far to the south-west. At the mouth of one of the branches of the Rhone is Aigues Mortes, a very important port in the Middle Ages, with ancient walls which rival those of Carcassonne. Marseilles is near the mouth of the Rhone; it was established by the Greeks as far back as 600 B.C.

The Romans conquered this region about 118 B.C.; and were attacked by the Cimbri in 105 B.C., and by the Teutons in 101 B.C. Caesar occupied the Burgundian Gate near Belfort about 57 B.C. As mentioned in an earlier chapter Christianity advanced up the Rhone Corridor as early as the second century A.D., and, it is believed, reached the middle Rhine about this date also. In another volume⁶ I have shown how education in the form of the earliest universities spread up this valley long before they entered Germany or Spain. So also the history of the development of the Renaissance is linked with this route by which ideas from Rome and Italy spread to Paris and Britain. It was not till about the middle of the fifteenth century that we find that major factors in the spread of civilization—such as the invention of printing at Haarlem and Mainz—were being developed far to the east of this famous corridor, justly known as the “Way of Light.”

(6) *The Narbonne Corridor*

Today this corridor is probably of less importance than any of the others here considered. It leads from the Mediterranean to the Atlantic along the northern edge of the Pyrenean foothills, and does not connect directly with the northern plains of Europe. The corridor, like several others already described, is a lowland area between young

⁶*Environment and Nation*, Toronto, 1936.

mountains and a relic stump; in this case between the Pyrenees and the central block of the Cevennes (Fig. 84). As a glance at Fig. 79 will show, it forms the eastern gateway of the Bordeaux basin, and was commanded in early historic times by the Gothic city of Toulouse and the fortified city of Carcassonne (p. 211). Today it is traversed by the Canal du Midi. Here are grown large quantities of fruit and vines, and there is some local industry based on oil and leather. In the very early times of the Paleolithic age this was a great centre of human energy; and the "metropolis" of that period of human development was perhaps at Les Eyzies—eighty-two miles due east of Bordeaux. In caves in this part of France and in the Pyrenees nearby are preserved the "art galleries" of Paleolithic man.

Narbonne seems to have been an important Gaulish town long before the Roman Conquest. In 116 B.C. the Romans occupied it, and it became a rival of Marseilles to the east. The province of *Gallia Narbonensis* was administered from this town; and later it was of much importance in the times of the Visigoths. About 1300 the canal connecting it to the sea became silted, and Beziers, a few miles to the north, is now a much larger centre of population. Further notes on the history of this corridor will be found in the account of Carcassonne.

(7) *The Straits of Gibraltar*

To complete our study of the gaps in the great mountain barrier a few words must be added concerning Gibraltar. Here there is a break from nine to twelve miles wide (which is occupied by the sea) in the young mountains, which approach the straits fairly closely on both sides. The famous rock of Gibraltar is an isolated ridge of lower Jurassic limestone about two and a half miles long (Fig. 85). At the north end it rises almost vertically from the lowland of the "neutral zone" separating it from Spain. The highest point, towards the southern end of the sharp ridge, is 1,400 feet above sea level. The geology of the rock shows us that there have been a number of ups and downs in the vicinity in late geological times, so that "strait" has alternated with "isthmus" more than once. Probably the Barbary apes, which live in small numbers in caves in the rock, arrived here during one of the periods when there was a land connection with Africa. The east side is so steep that there is no settlement, except for some fishermen in Catalan Bay near the neutral ground.

During Roman times the two headlands bounding the straits were known as the "Pillars of Hercules," Gibraltar being known as *Calpe*. In A.D. 711 the Visigoth king invited the Moorish leader Tarik to assist him, with the usual result that the Moors declined to return after they had won their main battle at Jerez. The rock has been known as "*Jebel Tarik*" (i.e., Gibraltar) since that time. The Moors built a very strong fortress here before 742, and the keep is still preserved (Fig. 85). In 1309 the Spanish captured it from the Moors. However the Moors

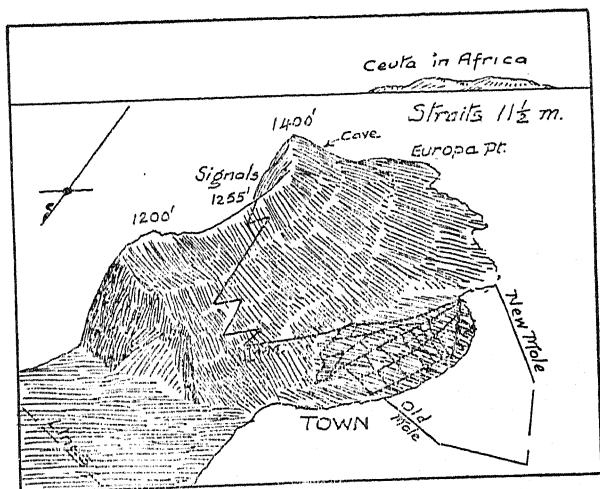


FIGURE 85.—A sketch of Gibraltar, looking south across the Straits. The Moorish keep (M) and Monkey's Cave are indicated.

regained the rock; after seven futile sieges the Spanish acquired it permanently in 1462. It was captured by the British and Dutch in the War of the Spanish Succession in 1704. It was attacked many times by the Spanish and French, notably in the great siege of 1779-83. On September 8, 1782, the attack of ten large ships was repulsed by using red hot shot, which set fire to all the vessels. Finally in February, 1783, the gallant defence by Sir George Elliot came to a successful end, and there has been no important military struggle there since that time.

Gibraltar has been a vital "strong point" of the British in the Mediterranean; and, with the similar naval bases at Malta and Alexandria, it has effectively neutralized Italian power in the centre. The rival nations built similar bases, such as that developed by France at Bizerta,

or by the Italians at Pantellaria and the Dodecanese. But the new air strategy makes these of considerably less importance today, though they are still of much value. Air fields of large extent linking major air lines, which can obviously be placed without so much consideration of land or sea corridors, are rapidly replacing naval bases and land fortresses as the key points in modern strategy.

THE QATTARA DEPRESSION—THE MOST STRIKING TOPOGRAPHIC FACTOR IN THE RECENT WAR

I cannot close this brief study of the important place which Mediterranean topography has played in the pageant of war and of civilization without a brief reference to the remarkable topographic feature which saved Suez and Egypt (and perhaps the Empire) in the recent struggle (Fig. 86). In June and July, 1942, Rommel with a mixed force of Germans and Italians drove the British in Libya back towards Alexandria at a rapid pace. Tobruk and Bardia were lost on June 21, and Matruh on June 29. On July 1 the Germans were less than fifty miles from Alexandria. However by July 3 it was clear that Rommel was held at El Alamein, and this breathing space was entirely due to the unique character of the topography.

To understand the origin of this immense hollow in the sandstone plateau of the desert, we must consider briefly the general geological conditions in Egypt. The northern portion of the country fronting on the Mediterranean is formed of level-bedded Tertiary rocks, chiefly of Miocene age. The rainfall is only a few inches a year; and the winds and extreme summer heat are the chief factors in eroding the landscape. During the day the sandstone expands with the fierce desert heat; in the night the cloudless skies permit rapid radiation of the heat, and the rocks chill and contract. This leads to a breaking up of the sandstones, etc., especially if they are rather *jointed* (i.e., cracked) to start with. The steady north winds of Egypt drive out the broken fragments of rock in long triangular dunes to the south. Most of the famous palm-tree oases of Egypt (such as Siwa, Karafra, Kharga, etc.) have such an origin; because when the upper several hundred feet of rock have been blown south in this fashion, the small amount of ground water can flow out in tiny springs in the cliffs of the depression and supply palms. Some true artesian water is also found in some of these great depressions.⁷

⁷See W. H. Hobbs, "The Erosional Processes of Deserts" (*Annals of American Geographers*, 1918).

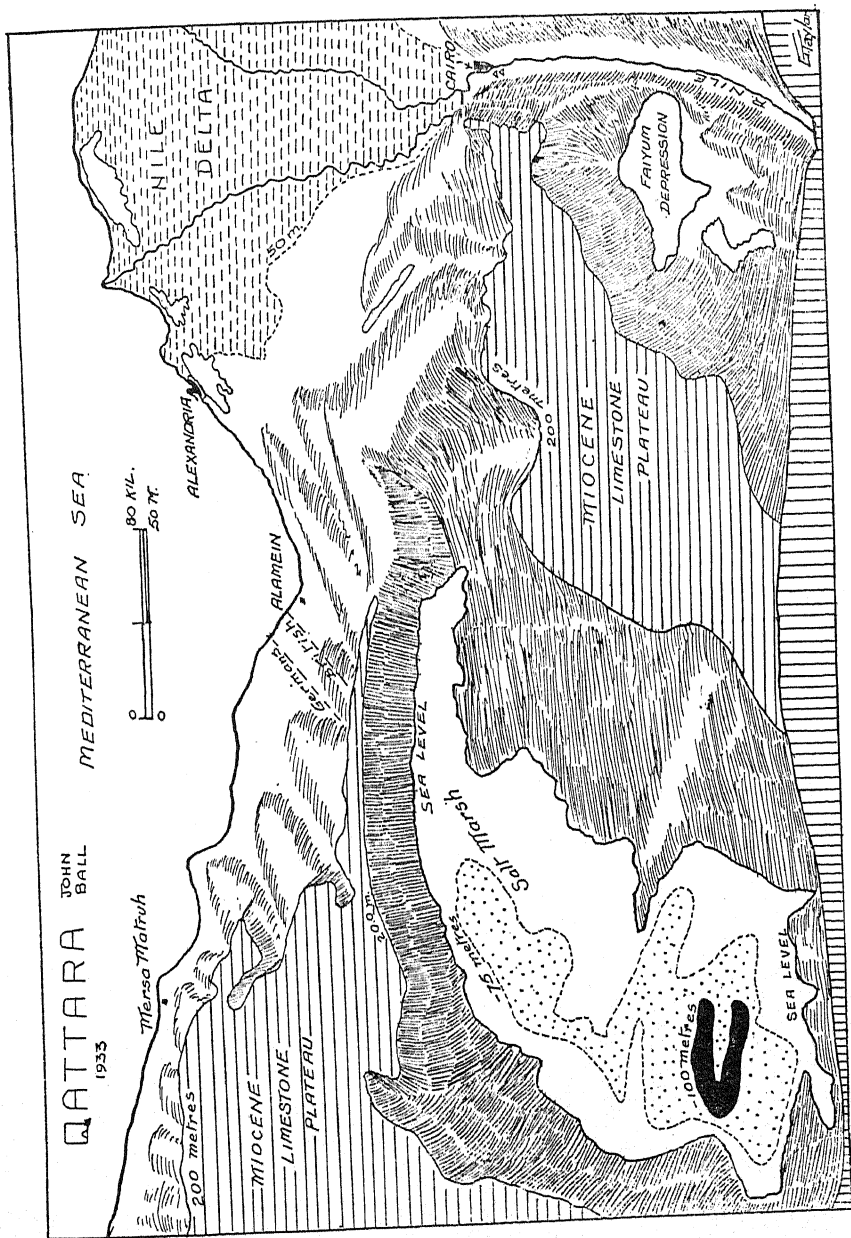


FIGURE 86.—The topographic feature which helped to save the British Empire—the great Qattara Depression, 180 miles long on the south flank of the defence lines at El Alamein, Egypt.

Turning now to the Qattara Depression, we find it is the largest of all, for it is 180 miles long and seventy-five miles wide at the southern end (Fig. 86). The most impressive feature is the long line of cliffs on the northern side of the depression, for this face is 275 metres (900 feet) high. The lowest point is near the western end, and is 400 feet below sea level. It has been suggested that a tunnel be cut through the thirty miles separating the depression from the Mediterranean, so that the salt water might be evaporated in Qattara and yield valuable salts of the sort obtained in large quantities from the Dead Sea. Possibly a good deal of power might be developed also. A large proportion of the floor is covered with sticky salty sand or sludge, which is nearly impassable. In Ball's opinion⁸ this depression acts as a sump for the great subterranean water sheet which supplies the springs found in the other oases to the south.

During the next five months Rommel was unable to drive the British from their positions along the lines of El Alamein. These extended for some thirty miles between the sea and the depression, and the latter acted as a giant trench 900 feet deep and 180 miles long on the southern flank of Montgomery's armies. Rommel made no attempt to turn the British flank, for to the south-west extended the Libyan Erg, the largest area of free-moving dunes in the world (Fig. 10). In the meantime the armaments of the British had been vastly reinforced, largely with the help of the United States. On October 23 Montgomery was ready to drive the Germans back, and by November 5 Rommel was repulsed from the lines which he had held so long. Three days later the Americans landed in force in north Africa, and Rommel's forces were caught and crushed by the two armies at Tunis and Bizerta on May 7.

It is worth a final note that the difficulties of the fighting in north Africa were greatly increased when Rommel reached the "young mountain" topography in January and February. Before that he had been fighting in the open country of the African shield area, where battles of manoeuvre are relatively easy.⁹ The fighting in northern Tunis was carried on amid the ranges of the Atlas, where the young

⁸J. Ball, "Qattara Depression" (*Geographical Journal*, October, 1933); with a fine contour map of the depression.

⁹See the definition of a shield in the present volume, p. 8.

mountains of Africa reach the sea, to appear again in Sicily and in Italy as the Apennines.¹⁰

TOPOGRAPHY AND THE DOWNFALL OF THE NAZIS

The foregoing pages on the struggle between the Nazis and the forces of a progressive civilization were written during the summer of 1943. Delays due to priorities and the shortage of paper and of skilled workmen, have postponed the appearance of this book for many months after V-E Day; but this has made it possible to summarize the closing years of the European war, and to stress the effect of the geographical factors.

I have compiled most of the salient events of this period on the map which appears as the Frontispiece of the book. Here we see the battle-fronts month by month, as the Allies gradually reconquered the Continental areas and advanced on Berlin. The map is a good illustration of the use of isopleths—which in this case represent approximately the battle-fronts about the middle of the month specified. Since about thirty months are involved in the period of freeing Europe, we find thirty isopleths charted on the map to the east of Berlin. Much may be learnt from studying their distribution.

Perhaps the chief purpose of the map is to show how definitely the major movements of the armies were actually controlled by the "young mountains," as was suggested in the preceding pages. All elevations over 3,000 feet appear as black patches in the map. These are all young mountains with one or two minor exceptions on the northern fringe, such as the Cevennes, the Vosges, and the relic blocks around the Bohemian region in the vicinity of Prag. These latter small areas are flat-topped relics of the preceding period of mountain-building (p. 281).

In spite of the great importance of the air forces, it was the infantry and tanks which administered the *coup de grâce*, and they were almost as much affected by the topography in this war as in 1914-18. I propose to examine the various major thrusts of the campaigns, and to show that they accord well with the principles explained earlier.

¹⁰Should the reader care to follow up this study of the effect of topography upon war, he will find the best book on the subject is *Battlefields of the World War* by D. W. Johnson, New York, 1921. It deals of course only with the First World War.

During 1939, 1940 and 1941 the Nazis were winning almost every campaign in Europe; so that by March, 1942, they had penetrated far into northern Russia and seemed on the point of capturing Moscow and Leningrad. They were held at Leningrad for over a year, and were beaten back from Moscow during the summer of 1942. However in the south of Russia their attack in the autumn of 1942 met with great success; so that by November, 1942, they had nearly reached the Caspian Sea, and had obtained control of some of the oilfields north of the Caucasus.

The regularly dated isopleths of the map begin with December, 1942. The Russian battle-front at the end of the year is shown by the heavy line extending from Leningrad to Vitebsk, Stalingrad and Grozny. This month was the turning point in the Second Great War. At the same time the British and Americans had almost driven the Axis out of Africa, as appears at the bottom left corner of the map. But this section of our study is mainly concerned with the advances from east and west upon Berlin.

Two outstanding features can be seen at a glance when we observe the isopleths of movement. First, the campaign consisted of a period of preparation usually four to seven months long, followed by a rapid advance over considerable enemy-occupied territory. Secondly, the "bulges of attack" are almost wholly confined to the northern plains, or to one or two of the corridors discussed earlier in this book.

Let us examine the Russian advances first, as shown in the Frontispiece. After the relief of Stalingrad, there was fairly steady progress to the west during December, January and February of 1943. Now occurred one of the longest periods of consolidation (along the Donetz River) which lasted for nearly five months with little change of territory. This is of course indicated by the close-set character of the five isopleths passing through or near Kharkov (KH. on the map). There followed the great advance of the summer and autumn of 1943 across the relatively flat plains of the Ukraine. This advance moved over large areas in the latitude of Kiev, and was not materially halted by the winter in this part of the plain. But the Germans offered fierce resistance in the south, in their effort to control the iron of Krivoi Rog, and the richer farmlands north of the Black Sea.

Another period of consolidation followed in the spring of 1944, which was to no small degree due to the presence of the Carpathian

Mountains which lie just to the west of Chernowitz (*CHE.*) Here the Russians left behind the great plains, so suitable for their tanks and artillery, and confronted rugged terrain with mountains rising to seven or eight thousand feet, pierced only by narrow passes.

As a matter of fact they made no very pronounced attempts to pierce the passes and invade the flat plain of Hungary (which lies to the west of the Carpathians), since in August of 1944 the Roumanian king surrendered all his armies to the Russians. This left the Nazis in a precarious position, and they made the Danube and the fortress city of Buda-Pest their next line of defence. The Russian armies therefore traversed or by-passed the Carpathian wall without much trouble during the autumn of 1944, and in November, 1944, (while their northern armies were consolidating at Warsaw) drove to the west, both north and south of Buda-Pest. In the vicinity of Lake Balaton and the angle of the Danube the Nazis held back the Russian forces for some months during the winter, only to be driven through the Vienna corridor (between the Alps and the western Carpathians) during the closing months of the war.

Let us now turn to the main advance towards the heart of Germany and Berlin. During the summer of 1944 the Russians made what was perhaps their most spectacular advance in the whole war. In a few weeks, during July and August of 1944, they liberated "White Russia," and the debatable lands north and south of Brest. Our map indicates this remarkable advance by the great width between the isopleths for June and August.

Warsaw and the upper Vistula were held by the Nazis for some months at the end of 1944, but early in the new year the Red armies pushed forward very rapidly across "Ethnic Poland" and the east of Germany proper. The Sudeten Mountains deflected the attacks somewhat to the north-west, and no determined attack on the Nazis in Bohemia occurred until Berlin was invested during the month of April, 1945.

The invasion of the Nazi-held territory in France (as charted in the Frontispiece) showed somewhat the same features. The main landings on D-Day were on the shores formed of the softer formations of the Paris basin north of Caen. To the west the ancient rocks of Brittany and of the Cherbourg peninsula produced more precipitous coasts, where the Allies were not so successful in attaining a landfall. After

a month of fighting with not much territory won, the period towards the end of August, 1944, saw the most spectacular gain by the western Allies across the Paris basin, as shown by the great distance between the isopleths for mid-August and mid-September.

In the south of France the new landing in August, 1944, was directed at the "Way of Light," i.e., the valley of the Rhone, which has determined the line of invasion in so many past episodes of European history. The Allies—joined by the French—drove the Germans back through the Belfort Gate (B.) and into the Rhine graben near Strassburg. The line of "relic blocks" of the Vosges and the Eifel, combined with the wide valley of the middle Rhine, blocked the allies for nearly six months, until the final grand break-through occurred in March, 1945. The next month saw a rapid advance, much like that of the preceding September, which brought the Allies up to the Elbe. Here they halted, though the right wing of the Allies continued to advance towards Vienna down the great downfold in which the upper Danube flows. Here in the vicinity of Linz the western armies met the Russian forces who had just captured Vienna.

The chief value of the Italian campaign during 1943 and 1944 seems to have been to keep a large number of German divisions under fire, where they could not be of any use to the main German resistance in the north German plains. Of course the Italian campaign freed the Mediterranean for Allied shipping, but it was never a direct attack on the heart of the German resistance. The same was true as regards the fighting in Greece, and the gallant struggles of the Yugo-Slavs. Thus the so-called "soft under-belly" of the Reich was in reality an extremely satisfactory southern defence for the Germans; and was never traversed by the Allied forces in its entirety, except by the small armies advancing up the Rhone valley. The Hungarian campaigns do not contradict this statement, for the Danube valley only cuts across the northern "Alpine" elements of the barrier of young mountains. To cross the whole mountain barrier, it would have been necessary to advance through the Brenner Pass; or through the Peartree Pass; or through the Uskub Pass on the Morava-Vardar Corridor (see p. 285). None of these three vital passes was used by any large army; so that we can say that the Nazis were almost completely protected on the south by the "young mountains," and were defeated by direct attacks from the east and from the west along the plains.

CHAPTER XIII

GEOGRAPHICAL FACTORS IN THE PEACE PROBLEMS OF EUROPE

THE SORE SPOTS DUE TO VERSAILLES

THE last two chapters dealt with the problems of war. We may now turn to certain aspects of the future peace in which geographic data are of considerable value. There seem to be two main fields in this connection. First of all there is the actual settlement of the national boundaries and fields of political activity in various parts of the world; secondly, we may attempt to chart the trends of present human migration and growth, so as to learn something of the distributions of populations and civilization in the next hundred years. Each of these fields is large enough to occupy a volume for its elucidation; so that, as in earlier chapters, the discussion will be confined to one or two geographic sections of the main problem.

A number of geographers, including the present writer, have written on the political geography of the Europe which developed as the result of the Treaty of Versailles after the First Great War. In my book *Environment and Nation*,¹ I gave a map of central Europe which shows the "sore spots" which still survived the well-meaning attempts of the politicians at Versailles and other treaties of the time. We may well make this map (Fig. 87) the starting point of our present discussion.

In accord with the wishes of the dominant member of the peace conference, President Wilson, the principle of self-determination was adopted as the leading motif of the treaty. But the various nationals at the table were but human, and most of them tried to enlarge the territories of their own nations. France, with "Tiger" Clemenceau as her representative, had only one main object—to reduce Germany to impotence, and to increase in every way possible the power of France's allies, especially Czecho-Slovakia and Poland. It was not hard to forecast that the weaker conquered nations would be the chief sufferers in the final decision. Let us see how the various nations gained or lost

¹Toronto, 1936.

in the debates, accepting as our criteria the cultural boundaries which have been discussed and in part charted in chapter viii.

Two countries benefited remarkably. One of these was Roumania, which has never been a warlike nation, which lost its campaigns during the Great War, and which had obtained control of large areas rather

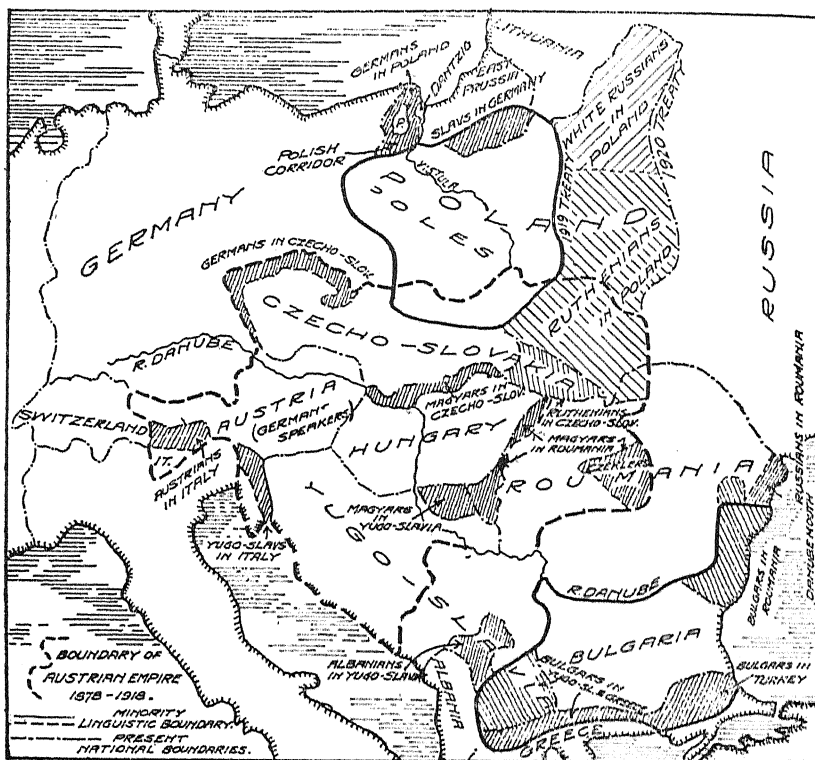


FIGURE 87.—Map showing the "sore spots" of central Europe after the peace decisions of 1918-20. All the ruled areas are occupied by dissatisfied minorities. Note especially the boundaries of Poland, which include a huge Russian area; and the cultural boundaries of Bulgaria which are far beyond those allotted at the peace of Versailles.

by a process of peaceful penetration than by conquest in the past. The dot-dash line in Fig. 87 shows the boundary of Roumania after the treaty. It includes an oval area stretching from the Danube to Czecho-Slovakia, and is not far short of double the area of pre-war Roumania. Included within the national boundary are four "sore spots," which

are indicated by the close ruling in Fig. 87. In the very heart of the country are the Czeklers of Transylvania. These are Hungarians who have been in that region for centuries, though the Roumanians have spread into the lowlands all round them from their main centres in the Carpathians and east thereof. In the plains of the Alföld on the western margin many thousands of Hungarians were also placed under the Roumanian flag.

In the north-west Roumania obtained control of districts settled by the Ruthenians, who are close to the Ukraine Russians in culture. So as to gain an outlet to the Black Sea, the littoral between Bucharest and the sea was taken from the Bulgarians (another conquered nation) and given to the less warlike Roumanians. To the north of the Danube mouths much of Bessarabia—settled by Turks and Russians in part—was also handed to the Roumanian people. (Russia at that time was in the throes of the Bolshevik revolution.) It is difficult to understand the policy of the Roumanian rulers; for the bitter enmity of Hungary, Bulgaria, and Russia was ensured by these "grabs." Only in the case of the Czekler territory was there an excuse for inclusion in Roumania, since the Czeklers were so isolated from their brothers in Hungary proper.

Let us now turn to the case of Poland, where the final arrangement was, in the writer's opinion, even less justified than the adjustments of Roumanian territories (Fig. 87). In the Treaty of Versailles the commission suggested a fair eastern boundary, which is labelled on the map as the 1919 treaty line. This passes through Brest-Litovsk, and runs through the districts where the population is half Polish and half Russian. But during 1919 and 1920 the Poles and Bolsheviks were at war; and the Poles were greatly helped by French soldiers. As a result, the Poles drove the Russians far to the east of the Polish cultural boundary; and in 1920 the young Bolshevik party thought it well to accept the hard conditions laid down by the Poles.

As a result the new boundary was laid down far to the east of Brest-Litovsk, where the line on the map is labelled "1920 Treaty." An overwhelming proportion of the folk in this huge region are Russians or Ruthenians (i.e., Ukrainians); and they belong to a different church and speak a different language from the Poles. The Poles point out that they controlled this large area for a number of centuries before the great partitions of Poland in 1772-95, and a number of the wealthy landholders in the country are still Polish in culture. Yet on

the principle of self-determination all the region shown by diagonal ruling should have been allotted to Russia. During the inter-war period the present writer has constantly stressed the insecure position of Poland, with the Russian Colossus gaining more and more power just to the east. During 1939 Russia marched into this debatable region and took control of it. It is to be hoped that the Poles will acquiesce in the eastern half of their huge 1920 territory remaining in Russian hands now that the great conflict is over.

Bulgaria was a defeated nation in 1919 with little power to prevent the distribution of its marginal areas. The borders of Bulgarian culture are shown by the heavy solid line in the map (Fig. 87). In the south-west is the land of the Macedonians, who have been claimed as compatriots by Serbs and Bulgars alike. Macedonia lies on the margins of Serbia, Bulgaria, and Greece; and has always been coveted by each of these nations. In religion and culture it seems to be rather closer to Bulgaria than to the other two nations, and is so indicated in the map. About twenty years ago the Greeks settled a million Greek refugees from Anatolia in southern Macedonia, thereby much strengthening their claim on this portion of the area (Fig. 88). Bulgaria was again on the German side in the recent struggle, though the bulk of the people, as usual, are admirers of the Russians, and were not at all anxious to help Germany in the war. In the south-east corner there is a great intermingling of Bulgars and Turks, and here also the Bulgars suffered in the 1919 adjustments. On the whole this nation seems to have been the worst treated of the enemy countries by the Treaty of Versailles.

Italy in the Great war was on the winning side, but was very dissatisfied with her territorial gains. As a matter of fact not many Italians in 1914 were under a foreign flag except in Tunis and in the southern Trentino around the town of Trento. The logical boundary in this last area, as pointed out in the detailed discussion of the Trentino (p. 293) is through Salorno, but the Italians insisted that it be located at the Brenner Pass, thereby placing 200,000 Austrians under the Italian flag. In the hinterland of Trieste they also obtained control of large areas inhabited by Slovenes, allied to the Croats and Serbs. It seems possible that these districts may be restored to Austria and Yugo-Slavia, but the final boundaries have not yet been made public.

Hungary has always been particularly bitter as the result of her territorial losses in 1919. Many purely Hungarian districts were handed to Czecho-Slovakia in the north (Fig. 87), so as to enable the Czechs

to use the Danube, and to construct longitudinal railways to link their mountainous territories. In the Banat in the south-east the Hungarians were despoiled to increase the lands of the Yugo-Slavs. Transylvania in the east was one of the most important regions of Hungary, partly because it remained relatively free from Turkish occupation during the struggles in the seventeenth century. Taking advantage of the recent conflict the Hungarians occupied a large part of former Czecho-Slovakia and Roumania (Fig. 89), so that the Hungary of today has more nearly the area which it had before 1918. To include the bulk of the Czeklers the new Hungarian territory inevitably contains thousands of Roumanian peasants. Here again the boundaries are not yet final.

There were many more "sore spots" in Europe, notably the Polish Corridor, but enough has been written to show how difficult it is to use cultural limits as the criterion of national boundaries. For instance, it would seem to have been a much better plan to have made the Polish outlet to the Baltic run between Lithuania and East Prussia, rather than to split the Junker lands of East Prussia from their brethren in Germany to the west. The Sudeten German lands on the northern border of Czecho-Slovakia might logically be transferred to the adjacent Reich, except for their peculiar location on the flat horst-blocks which form the boundaries of Czecho-Slovakia. The Czechs felt that these natural bastions of their land should be ruled by themselves, especially as the German occupants had lived peaceably within the Austrian (anti-Prussian) Empire for several centuries. However, most of the Sudeten Germans are now being transferred to pre-war German territory.

BOUNDARY CHANGES IN GERMANY AND POLAND 1939 TO 1946

As a result of the recent war very great changes have taken place in the territories of Germany and Poland. These are charted in Fig. 87a. The major "sore spot" shown on Fig. 87, as stated, has been removed, since these lands containing few but Russian folk have now been incorporated in the U.S.S.R. The Curzon Line, suggested at the end of the 1914-18 war, has been adopted almost wholly. As some recompense for this loss, and for the damage caused by the Nazis, very large areas have been given to Poland. Southern "East Prussia," where Mazurian Poles lived, has been allotted to Poland; while the Soviets take the northern portion of this area, including the port of Königsberg.

On the west of Poland the Poles have moved a hundred miles to the west, regaining territory from which they were displaced centuries ago. The Germans of Pomerania and Silesia have been driven west into the lands allotted to the Reich. The map also shows the methods adopted for the administration of Germany and Berlin (in the inset) during the temporary occupation of the diminished Reich by the four conquering nations.

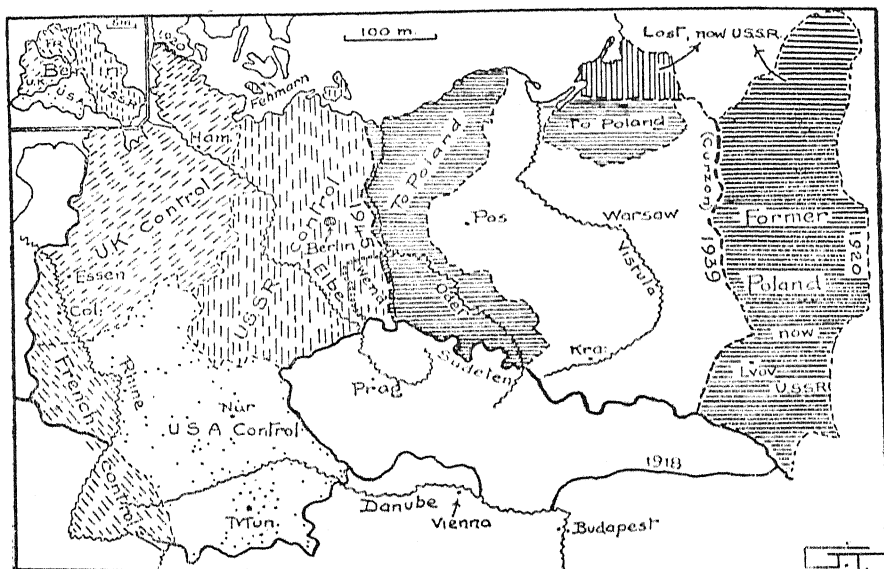


FIGURE 87a.—The Slavs move west. The Soviets gain much of former eastern Poland, the Poles gain much of Prussia. The administrative areas in the Reich (and in Berlin) temporarily occupied by the four victorious nations are shown. (Based on maps from *Free Europe*, Sept., 1945.)

HOW MAY THE "SORE SPOTS" BE REMOVED?

There would seem to be three major methods by which these sore spots or Irredentist areas may be removed. The Nazi plan is quite simple, for at times they have proceeded to slaughter most of the settlers in a district who do not fit into their plans for a uniform, Nazi-loving population! They have however adopted less drastic measures in some instances, and have transferred large minority populations, and placed them with their fellow nationals. For instance many Germans who lived in Lithuania have been brought back, probably often

enough not very willingly, into the heartland of German *Kultur*. It is not easy to obtain accurate data as to this migration; but there is another example of the same kind which should be familiar to all students who hope to see the sore spots removed from the map of Europe.

For several years after the close of the last Great War there was bitter fighting between the Greeks and the Turks. This ended in 1922 with the defeat of the Greeks, and as a result the territory around Smyrna in Anatolia (Fig. 88), which in 1920 had been allotted to

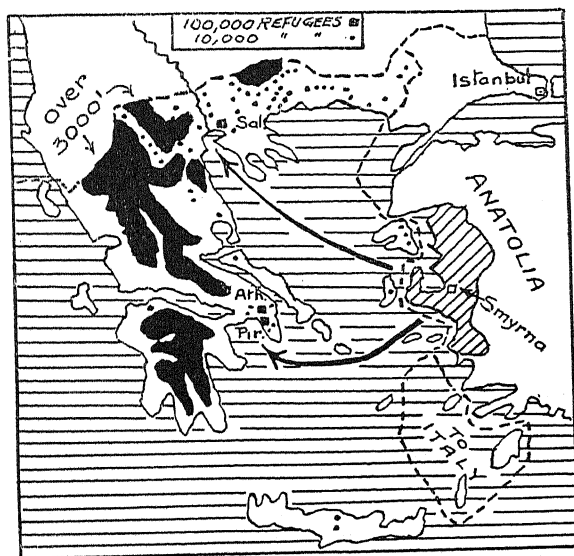


FIGURE 88.—Map illustrating the exchange of Greek and Turkish populations after 1923. The area with a former Greek majority in Anatolia is ruled.

Greece, was transferred to Turkey. From a continental point of view this might seem to be logical, since Smyrna is in Asia, while Greece is a European nation; but the Greeks had strong reasons for wishing to retain Smyrna. In the first place it was their largest city, although so far removed from Greece. Athens at that time had only about 168,000 inhabitants, while there were some 350,000 Greeks in Smyrna. The adjacent islands had been part of Greece, and were occupied by Greeks from the earliest days. The shore of Anatolia was of course

settled by Greek colonists in prehistoric times, while the Turks did not arrive here till about A.D. 1300. However the Turks were determined to control all the mainland, and as a result, in 1923, the most remarkable migration in Europe took place.

The most interesting feature about this migration was that it was an exchange of nationals, the Turks in Greece moving into Asia while the Greeks left Anatolia, and also to some extent Istanbul and Bulgaria in Europe. There were 1,850,000 Greeks and 350,000 Turks involved in this exchange; so that it is clear that the Greeks had to be more closely "packed" in Greece than was the case with the migrating Turks in Anatolia.

It has been estimated that some 70 per cent of Greek land is too mountainous to be of much value for settlement. If we subtract this from the total area, then the density of agricultural population in Greece is almost 15 per cent greater than it is in Belgium.² A small nation of about three million people was suddenly called upon to find new land or industries for one and a half million newcomers. About 300,000 settled in Athens and the adjacent port of Piraeus. Another 350,000 took the places of Turkish farmers who moved out of Greek Macedonia; while the remaining 1,250,000 were located on waste lands or in certain northern towns, notably in Salonika. "Since their arrival the land under cultivation has increased over 40 per cent, and in Macedonia has nearly doubled. Another change is that more valuable crops are now being raised, the acreage of tobacco being threefold what it was. Cotton shows a similar increase and is now raised on 50,000 acres or more."³

It would seem not impossible to exchange the Czekler (Szekler) farmers of Transylvania, who number about half a million and are of Magyar (i.e., Hungarian) culture, for a similar number of Roumanian farmers in the region to the west of the Czeklers (Fig. 89). The same procedure might be used to advantage in the case of many other smaller minorities who might become the nuclei of Irredentist conflicts in the future. But the use of common sense and goodwill as exemplified in Switzerland would be a far better solution of all these difficulties. This aspect of the problem will be discussed more fully later in this chapter.

²See the valuable discussion of Greek geography by Samuel van Valkenburg and Ellsworth Huntington, *Europe*, New York, London, 1935.

³Van Valkenburg and Huntington, *op. cit.*

THE NAZI REDISTRIBUTIONS OF POLITICAL BOUNDARIES

One would hardly expect the Nazis to exhibit much statesmanship in rearranging territories, but I have endeavoured to show in Fig. 89 some of the new boundaries, drawn since 1938, which have at least temporary importance.^{3a} During the period of truce with the U.S.S.R. eastern Poland was annexed by the Soviet Union, and as stated earlier there seems a good deal to be said in favour of this change.



FIGURE 89.—Temporary territorial changes in the period 1938-41. Major changes shown by ruled areas; less striking changes by dotted areas. Some of the boundaries near Croatia are approximate only

This area is shown dotted in Fig. 89. But the next year Roumania was subjected to partition in a very drastic fashion to placate Hitler's more powerful allies. Bessarabia, the north-eastern section of Roumania, (Fig. 89) was returned to the U.S.S.R. although much of the region was settled by Roumanian peasants. Only near the Black Sea was there a district with a majority of Russian settlers. This area is shown dotted,

^{3a}A very useful publication is *Atlas of World Affairs* by C. H. MacFadden, H. M. Kendall, G. F. Deasy (New York, 1946), containing 200 maps. It deals with all political changes until the end of the war.

while the rest of Bessarabia is shown by rulings—since it is not controlled by the dwellers therein. One would like to see a plebiscite taken in this area in the near future.

In addition to grabbing lands from Roumania, Hungary has moved north into Ruthenian districts bordering former Poland. This will bring it into conflict with the powerful Soviet Union. More easily understood are the annexations from Slovakia and from the Banat (in the west and south respectively of former Hungary), since these contain large numbers of Hungarian settlers. These recent accretions make the Hungary of 1943 a very queer-shaped country, and double the territory which she was awarded by the Treaty of Versailles.

Finally a few words may be said about the mysterious kingdom of Croatia (Fig. 89). When Yugo-Slavia bravely opposed the German armies in May, 1941, the Croats were divided in their sympathies. Most of them were rather unfriendly to the Serbs, but preferred these close cultural "relatives" to the Italians, Germans, or Hungarians. There was however a large group of Fascist sympathizers under Pavelik, which supported Hitler, and it took control of the land of the Croats at the close of the brief war with Germany. Within the next few months a separate kingdom of "Croatia," under the Führer Pavelik, was set up, with the support of Hitler. The writer has not seen a detailed map of this new kingdom,⁴ but it agrees fairly closely with the area indicated by "dashes" in Fig. 89. An Italian prince of the House of Savoy was offered the crown but apparently he did not feel it wise to take over his kingdom! Bulgaria seems to have occupied the southern half of Serbia in 1943, so that this boundary will need great readjustment.

Mussolini took this opportunity of Slav disaster to grab the territories adjacent to Italy, though few or no Italians live therein. Thus he annexed the flourishing farmlands of Slovenia and the coasts of Dalmatia along the east of the Adriatic. Ragusa (Dubrovnik) is the sole port of note which the Italians left to the new Croat kingdom (Fig. 89). There is no doubt that these Italian annexations will be restored to the Slavs; but students of post-war problems must know something of the drastic changes which have occurred here in the last few years.

⁴See however, the London *Nineteenth Century*, August, 1943, for a valuable discussion with a map.

THE FORMER MID-DANUBE EMPIRE: A WORKABLE ECONOMIC UNION 1700-1900

There is one chapter in the European history of the last two centuries which is well worth discussion with respect to the present problem. Most descriptions of the former Austro-Hungarian Empire lay great stress on the diversities of race, and but little on the fairly satisfactory economic interplay which marked this long-lived empire. This wrong emphasis on race is all the more absurd, since there is no real racial diversity; for all the culture-groups concerned belong to the

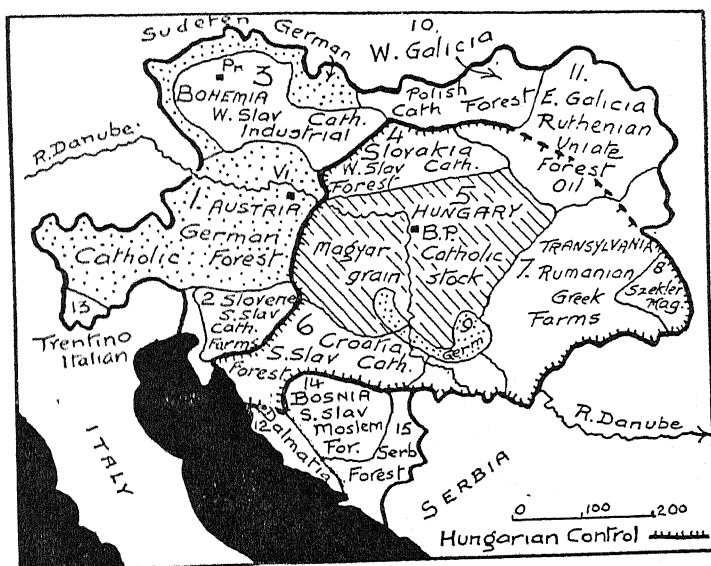


FIGURE 90.—The fifteen cultural groups which composed the Austro-Hungarian Empire before the Treaty of Versailles. Note how the languages, religions, and products of the groups vary. The two dominant groups are dotted or ruled.

brakeph Alpine race, as may be seen by a glance at Fig. 50. But as regards cultural diversity it is doubtful if any other empire ever contained so many different components within 240,000 square miles.

In Fig. 90 the fifteen culture-groups involved are identified by numbers, the order of the figures representing to some extent the order of their annexation to the Austrian Empire. After the Turks were driven out of almost all this region at the beginning of the eighteenth

century, the Germans of the Austrian areas in the west held the reins of government for a long period. But after the *Ausgleich* (i.e., compromise) with Hungary in 1867, the Hungarians received accessions of power and territory which brought them almost to the level of the German groups, so that as regards internal policies the Hungarian "kingdom" was relatively independent of the Imperial Government at Vienna. It had its own port, Fiume, on the Adriatic, whereas Austria was served by Trieste. The boundary between the two divisions of the *Ausgleich* is shown by the heavy line in Fig. 90.

Let us now see of what components this empire was formed. The fifteen groups are almost all quite distinct from one another; for if the languages of two adjacent regions are alike, we may be sure that the religions or the economic interests are quite different. These divergencies can be most clearly perceived in a table, though the outstanding characteristics are added on the map in Fig. 90.

TABLE OF THE CULTURAL COMPONENTS OF THE
AUSTRIAN EMPIRE (FIG. 90)

Region		Language	Religion	Economic Interests
Austria	1. Austria	German	Catholic	Forest, iron mines, farms
	2. Slovenia	South Slav	Catholic	Farms
	3. Bohemia	West Slav	Catholic	Coal, factories, farms
	10. W. Galicia	Polish	Catholic	Forest
	11. E. Galicia	Russian	Uniate	Forest, petroleum
	12. Dalmatia	South Slav	Catholic	Fishing
	13. Trentino	Italian	Catholic	Farms, pastoral
	14. Bosnia	South Slav	Moslem	Forest
	15. Herzegovina	South Slav	Greek	Forest
Hungary	4. Slovakia	West Slav	Catholic	Forest
	5. Hungary	Magyar	Catholic	Grain, pastoral
	6. Croatia	South Slav	Catholic	Forest, farm
	7. Transylvania	Roumanian	Greek	Farm
	8. Szekler	Magyar	Protestant	Farm
	9. Fünfkirchen	German	Catholic	Grain

There is, of course, no doubt that all these cultural groups, except those living in regions 1 and 5, were greatly dissatisfied with the methods of government. All the power was collected in the hands of the Austrian aristocracy or the great landowners of the huge estates in Hungary. Yet it is obvious that the pattern is not more diverse than that of the Soviet Union today, where, amid many rather undemocratic

methods, those in control do seem to give real equality to the varying racial and cultural components of their vast empire.

The chief feature which interests us in this volume is, however, the remarkably self-contained nature of the diverse middle Danube area (Fig. 90). The districts are linked by this magnificent waterway, unrivalled in Europe, and for a time actually controlled by a sort of international administration, which we may hope to see restored shortly. The wheat crops and the herds of the great Alfold plain, enclosed and determined by the young folds of the Carpathian mountains, supplied a large part of the food of the Empire. These were raised chiefly in regions 5 and 7. All round this central plain was a belt of undulating fertile slopes, given to mixed farming; large parts of 1, 2, 3, and 6 were of this nature. A more marginal zone included the rugged portions of the Empire with abundant supplies of timber; and these were found largely in 1, 4, 10, 11, 14, and 15.

Rich deposits of coal, both bituminous and lignite, are found in Bohemia, and this became the chief industrial area of the Empire. Near Pilsen developed the vast Skoda munition factories, which formed one of Hitler's main sources of military supplies. Glass-making, pottery and brewing are also highly developed industries in Bohemia. Metal mines are not very abundant, though iron and salt mines of considerable value occur in the mountains to the south-west of Vienna. Gold and silver are found in Transylvania, though not in large quantities. The Ore Mountains to the west of Prague are rich in various metals, including radium. One of the world's chief sources of quicksilver is at Idria, north of Trieste.

One can readily understand the plight of Austria, after the First Great War, when it dropped from the position of the controlling unit of a vast empire of fifty-one million people, to the status of a small state with only six and a half million. Especially hard was the lot of Vienna, which had a flourishing population of 1,700,000 as the centre of the great empire. After the war this huge population was clearly too much for the capital of a small state of one-eighth its former importance. The surrounding states, glad to be free from the control of Austria, placed tariffs which hindered her from receiving the raw materials upon which her manufactures were based. Vienna lost much of her trade on the Danube, and most of the marine commerce, which used to reach Vienna from Trieste, was gained by Italy. Not much

better was the condition of Buda-Pest, the capital of Hungary; but since it was more concerned with agriculture and less with manufactures it did not suffer so much as Vienna.

There are many geographers who feel that a reconstructed "middle Danube union," with a democratic form of government like that of the United States, or Switzerland, will be a considerable improvement on the state of affairs in the period 1919-38, for self-determination has not proved a panacea by any means. It has led to the rise of customs barriers between the numerous small nations which have greatly hindered the growth of trade and prosperity.

Small nations are a natural prey to jingoistic dictators. Yet it seems quite unnecessary to have a completely independent state, if one desires to conserve the best of one's particular culture. Many folk do not realize that the British Empire offers a number of examples of free cultural minorities. For instance the Boers in South Africa have become reconciled to their union with the Empire, as also have the numerous French in Canada. Both would clearly have been in jeopardy from Hitler had they been quite dissociated from the Empire. The same holds true with regard to Eire, which, however, has received all the benefits of the protection of the Empire, but has made no effort to help England as she might. For instance, as regards naval bases, certain of these would have been of great value in the recent years of stress.

For these and other reasons it seems logical to the writer to place much less reliance on self-determination as a cure for Europe's troubles now, than he did in 1918-19. Furthermore it is well to realize that there is a considerable difference in the outlooks of the "Englishry" (to use a convenient term for "English-speaking peoples") and of other European peoples. Wertheimer makes some very pertinent remarks on this point in his recent book *Victory Is Not Enough*.⁵ He says that the League of Nations was the invention of the Puritan Anglo-Saxons, who laboured under the delusion that moral force was strong enough to determine European policies. The French and nations of central and eastern Europe had very little confidence in this ideal. He declares that Versailles resulted in the creation of twenty-seven sovereignties; and that we must imitate the totalitarian powers in one respect, i.e., in stressing Union for common advance rather than

⁵New York, 1942.

disruption which leads to weakness. The emphasis on Nationalism is a step backward; we need to replace national force by community of force.⁶

To return for a moment to the mid-Danube union, the writer does not in the least advocate a return to that dismemberment of the Roumanians and Serbs which resulted from the boundaries of the Austrian Empire of 1914. The chief desideratum is to establish a united bloc in central Europe, which will counterbalance the seventy million Germans. Probably a mid-Danube union, without the moieties of Roumania and Serbia, might be easier to administer; while these two nations could form economic and defensive alliances with the groups strung along the Danube. This suggestion of several large European blocs will be considered in the next section.

FAIR TRADE AS A BASIS FOR PERMANENT PEACE IN EUROPE

Nearly a decade ago the writer published a method of sub-dividing Europe into manageable units based on economic resources, and he is of the opinion that this approach to our difficult problem merits more attention than it has so far received. Trade and commerce are the means by which we come into closest contact with our neighbours. The prosperity of the world depends on "fair trading," and the Treaty of Versailles did little to advance this desired end.

Let us approach the problem therefore from the other end. Which countries in Europe are rich in coal but need grain or timber? Which have oil or water power, but lack metals or coal? In general we may agree that since climatic belts run west-east (owing to the lie of the isotherms), therefore trade will primarily move on north-south lines, i.e., between unlike environments. Probably the direction of world trade will follow this rule still more closely in the future, so that the interchange of temperate and tropical crops will to some extent replace the present flows between pioneer and manufacturing lands.

We are, however, in this chapter primarily concerned with the European continent; and here there are four west-east zones of agricultural production, as epitomized in the table (A) below.

⁶Wertheimer, *op. cit.*

A. MAJOR AGRICULTURAL ZONES IN EUROPE

No.	Position	Type	Countries
1.	North belt	Timber supply	Sweden, Finland, north Russia
2.	Cool agricultural	Rye, oats, potatoes	Southern Scandinavia, north Germany, Poland, Russia
3.	Central	Wheat and maize belt	France, central Europe, and southern Russia
4.	Mediterranean	Olive and wine belt	Spain, Italy, south Balkans

B. POWER RESOURCES OF THE CHIEF NATIONS OF EUROPE^a

	Britain	Germany	Russia	Poland	Bohemia	France	Belgium	Italy	Spain
Coal resources in 1,000 million tons	189	240	1,572	70	40	32	11	0	9
Coal mined per year, million tons	242	317	35	40	36	56	27	0	6
Water power in millions of h.p.	1	2	8	1	1	5	0	4	4
Petroleum supply in million barrels	0	1.3*	206	500*	0	0	0	0	0

*Million tons

Early in the war I pointed out that there are four logical "crop-power blocs" in Europe, which are sketched in the map in Fig. 91. Here again, as in the brief discussion of the Austrian Empire, I intend to do no more than draw the attention of the reader to certain fundamental geographical principles which underlie European power politics. I hope no one will quote this section as suggesting that Germany be encouraged to form a defensive and offensive alliance with Sweden and Italy. I merely show that the economic factors suggest certain rather natural associations.

In general the major power belt (whether of coal or oil) runs along the north of the "young mountains." The reasons for this distribution have been given in chapter xi. This belt extends from Scotland and Wales, through Belgium, the Ruhr, Silesia, the oil belt of Roumania, the Ukraine, etc., to Baku on the Caspian. Water power has naturally been more developed by nations which are poor in other power resources, such as Norway (ten units), Sweden (eight units), Spain (four), and Italy (four). It is worth noting that the one million horsepower generated by the waterfalls of Britain would only supply about

^aA German estimate in 1938 gives the coal resources in Europe: 200; 162; 113; 155; 40; 10; 11; 0; 9.

one-thirtieth of the power obtained from the coal mined there. A nation like Spain, however, with four millions of water power, is blessed with the equivalent of thirty million tons of coal, whereas she only mines about six million tons a year at present. As regards the great industrial countries like Britain, Germany, Bohemia, and Belgium it is clear that their enormous industrial power will not persist when the coal supplies are exhausted.

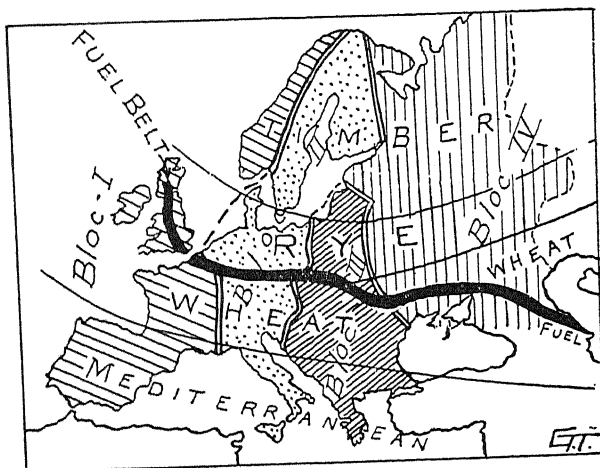


FIGURE 91.—A tentative division of Europe into four Power Blocs so that each bloc has adequate supplies of Timber, Food, Fuel, and Iron Ore. A plan which may develop after Germany has been rehabilitated.

TABLE SHOWING THE FOUR LOGICAL "CROP-POWER BLOCS" IN EUROPE

		I Western	II West-Central	III East-Central	IV Eastern
Crop units	Timber	Norway	Sweden	Lithuania Finland Poland Roumania	Russia
	Food	France England	Germany Italy		Ukraine Bulgaria
Power units	Coal	England Belgium	Germany	Poland	Ukraine
	Oil			Roumania	Baku
	Iron	France	Sweden		Ukraine

Probably the states of western Europe (Bloc I) will grow together as the northern products of Norway and the Mediterranean products of

Spain are exchanged for the power concentrated in Britain, north France, and Belgium. It will be remembered that Churchill actually proposed a complete union of France and England in the fateful days of June, 1940.

Bloc II includes the Great German coalfields, of which the Ruhr alone, it is claimed, contains half the coal of Europe. It should more and more attract the northern goods from Sweden, Denmark, and Finland, and the southern goods from Italy, with Switzerland and Austria. Bloc III is based on the Silesian coalfield, which was split in 1919 between Germany, Czecho-Slovakia, and Poland. Poland however received nearly 90 per cent of the coal reserves. It should supply power to Hungary and the Balkans; though the Donetz coalfield may attract the goods of Wallachia and Bulgaria, via the Black Sea. So also Lithuania and Latvia will probably link up with industrial Poland. The remarkable rise of the Polish port of Gdynia at the northern end of the Polish Corridor strikingly illustrates this urge for north-south trading. From a fishing village of 200 inhabitants, it grew in a decade to a city of 45,000 inhabitants (Simonds).

Bloc IV in Fig. 91 is the vast country of the Soviets; a little world in itself, which includes all four agricultural belts, and will develop its industry on the Donetz coalfield to surpass similar centres in England, Belgium, and the Ruhr. These economic attractions exist through all time despite man-made restrictions; hence it is appropriate to consider them here. It is admitted that many other aspects of the complex problems of post-war Europe have not been touched upon. But no statesman will produce satisfactory plans who ignores the inevitable results of the distributions of the main resources of food, power, and fuel.

THE REHABILITATION OF GERMANY

Although statecraft in Europe is largely concerned with political and psychological problems rather than with geographical ones, yet the writer ventures to include in this chapter a page or two summarizing his conclusions in the matter. The first fact to realize is that we have to live with the Germans in the future; and they will constitute some seventy millions or more of the most intelligent and energetic folk in Europe. Secondly the world is much smaller than ever before, we are "all in the same boat" now, so that disorder or damage in one end of the

"political craft" cannot be ignored by any country. Damage to Korea and to Manchuria is damage to the English and Americans. Wanton harm done in Ethiopia and Spain concerns you and me, almost as much as the unfortunate Ethiopian or Spanish democrat who first feels the blow. Surely few thinkers can any longer support an isolationist attitude.

Although in this chapter I have voiced some criticisms of the League of Nations, yet it remains the best international experiment the world has made on such a large scale. Of course there have been other experiments; and one—the International Postal Union—has worked so smoothly that most folk do not realize that here a body of well-trained experts (not diplomats or politicians, but business men) have been exercising international powers for many years. They act however not as *nationals* but as dispassionate workers for the common good. No appeal to such a senseless slogan as "my country right or wrong" mars their deliberations. We must in our future League of Nations try to get away from this nationalistic attitude.

As I stated in my book of 1936, "the aftermath of the Great War has been a poisonous growth of nationalism and high tariffs all over the world."⁷ Clarence K. Streit points out in his *Union Now*⁸ that we can learn much from the course of events in the United States between 1776 and 1788. The early Congress of 1766, based on a "League of Friendship States" (very like the League of Nations) was a dismal failure. It was not till the idea of control by inevitably jealous states yielded to that of control by *individual voters*—as exercised in the federal houses of 1788—that the government of the United States functioned satisfactorily.

The Council of Nations will do well to alter its machinery so that representation is based on the individual votes of the people, and not on those of national delegates with their clogging jealousies. With the widespread use of radio, and the knowledge which every educated person gains of great leaders, even in foreign countries, it does not seem impossible that the world council could be elected democratically. Such statesmen as Roosevelt, Churchill, Eden, Cecil, Smuts, Masaryk, Herriot, etc., might well appeal, to other nationals besides their own, as the kind of men best suited to control a world state.

⁷*Environment and Nation*, Toronto, 1936.

⁸New York, London, 1939.

Another interesting parallel is the gangster problem in the United States which could not be handled satisfactorily by the separate states, but is yielding to federal powers; so also the disasters due to the dictators can only be solved by a powerful league based on real democratic representation.

Gradually nations learn to abhor war. Perhaps only three of note (Germany, Italy, and Japan), remained unconvinced after the war of 1914-18. Surely we can assume that these have been converted by the ruin due to modern war, for the tempo of world education is being vastly speeded up. A logical solution of our difficulties now that the war is over would be for an adequate proportion of the air forces and navies of Europe and the United States to be formed into an international force under the new U.N., and for all the armies and other forces to be disbanded, much as was done for Germany in 1919. This force would control any munition factories which would be necessary; for no private firm should be permitted to make profit from the production of weapons of war. (See the note on atomic power.)

Germany suffers from her lack of democratic experience. Union for Germany and for Italy came only in 1870, and it needs more than two generations to train citizens to govern themselves. It is a platitude that Fascism and Nazism only flourish among dissatisfied people. Our conclusion should be therefore that we try in the future to make the Germans and Italians less dissatisfied than they were at the close of the last Great War. Yet there is no doubt that the difficulties will be greater after "World War Two" than they were in 1919, for the evil effects of a perverted education will be hard to eradicate. The young German will be little likely to trust statements from his conquerors, especially if he feels that they are greatly prejudiced against him. Anti-Nazi Germans will no doubt return to their homeland, but they are also likely to be deemed biassed. Wertheimer makes the interesting suggestion that the German-speaking Swiss would be ideal teachers in this connection, if they could be induced to take up this most vital branch of world sociology.

Many writers wisely stress the need for several years' delay after the complete submission of Germany, before the final terms of the peace are decided upon. The deliberations should take place in a neutral country, and Geneva certainly seems indicated as a better place

than Versailles. The writer is not much impressed by plans for splitting Germany into small, less powerful, self-governing units. Some publicists used to advocate the isolation of the Prussians with their Junker leaders; but they forgot that Hitler's major following was among the more easily swayed Bavarians of the Catholic south. The supporters of the ill-starred but democratic Weimar Republic were to be found in larger numbers among the northern peoples than in the Catholic south (Wertheimer). It has been often pointed out that the German loves a firm government; so that if only acceptable leaders for the new Germany can be chosen, there is likely to be much less opposition than for instance would occur under similar conditions in France. We are also told that a nation obtains the leaders that it deserves, and that the Germans and Italians have only themselves to blame for Hitler and Mussolini. It may be so, but the writer was much impressed by the rise of the late Huey Long in Louisiana, in spite of determined opposition by the more far-seeing of the Americans in that state. All of us who blame the Germans too strongly would do well to read the arresting novel by Sinclair Lewis, entitled *It Can't Happen Here*.⁹ It is fine propaganda for tolerance!

THE SAN FRANCISCO CHARTER, 1945

Owing to the publication of this book after the close of the European war, it is possible to include a brief account of the main features of the great Congress at San Francisco, which was held during the months of May and June, 1945. It was attended by delegates from fifty nations, and in the aggregate nearly a thousand representatives and advisers took part in the deliberations.

There are three aspects of this Charter which are undoubtedly great improvements on the constitution of the League of Nations. The new Charter pledges the United Nations to supply military forces immediately a jingoistic nation starts to make war. (The old League pledged co-operation but had no forces ready for action.) Secondly, the Charter puts the responsibility for keeping the peace into the hands of the "Big Five," i.e., Britain, the United States, the U.S.S.R., China, and France. This should obviate a great deal of the time-wasting debate which marked the old League. Thirdly, there is an economic and social

⁹Garden City, New York, 1936.

council of eighteen, whose duty it is to examine all the causes which make for war in a discontented nation. This is perhaps the most vital feature of the Charter.

The actual machinery to implement these resolutions is modelled on that of the League. There will be a *World Assembly* of fifty nations, where all subjects of interest can be debated. It passes on its conclusions to the *Security Council* of eleven members. Of these, five are permanently representatives of the Big Five, while six are come for two-year terms from the smaller nations. This Security Council can let slip the dogs of war upon any transgressor.

The *Economic and Social Council* will contain eighteen representatives. There will also be a *World Court*, which will act as arbiter in international disputes. The *Trusteeship Council* will have charge of the dependent peoples of the world, and will supervise the mandated areas. The *Secretariat* will be a permanent force of officers whose duty it will be to draw the attention of the various councils to problems as they arise.

CO-OPERATION IN ATOMIC RESEARCH

Scientific research offers one of the few fields where international co-operation is well-nigh universal. It is possible that the first use of atomic energy on a large scale, in July, 1945, may be hailed as the dawn of the Atomic Age, so that we shall do well to consider this notable stage in the evolution of our civilization. To the writer it seems more important than the dawn of the Electronic Age (De Forest, 1906); or of the Electric Age (Faraday, 1831). Possibly the invention of the practical steam-engine (Watt, 1763), and the first use of metals and of fire in the prehistoric ages, are of the same order of importance in man's development as a tool-using animal. Let us glance briefly at the leading events in the history of atomic research.

In 1895 Roentgen of Munich announced the discovery of X-rays, which are obtained by the discharge of electricity in a vacuum tube. In Paris in the same year Becquerel showed that uranium gave off similar rays spontaneously. The Curies of Paris in 1898 isolated the element radium, which was more remarkable in this field, for it gave off enough energy to melt its own weight of ice every minute. The writer was studying physics at Sydney University about this time, and

he can still remember his unbelief in this "creation of energy" without any apparent cause!

In 1905 a young mathematician in a Swiss patents office proved that a very small amount of "matter" could be transformed into an immense amount of "energy." His name was Einstein.

We now know that atoms consist essentially of several components. There is an outer "energy shell" consisting of revolving electrons, and an inner nucleus built up of electrified protons and neutral neutrons. The nucleus consists of "matter" billions of times denser than any which is familiar to us; and it is the number of protons in the nucleus which determines the character of the atom. All our early atomic laws of physics and chemistry were concerned with the "whole atom," and the experiments up to 1895 investigated only the outer "energy shell." We now know that heavy atoms, like those of uranium and radium, contain nuclei which are always disintegrating. In this process they produce various new products, as when radium changes to radon, and gives off alpha rays (helium), electrons, and X-rays.

While I was working at the Sedgwick Museum in Cambridge in 1907-8 I heard from my post-graduate colleagues in the adjacent Cavendish Laboratory of the remarkable work being done by Sir J. J. Thomson and his staff. It was the first investigation of the electron, and this was later followed up by Millikan, the American physicist, in 1910. He proved that the electron had a mass about one two-thousandth of a hydrogen atom. Rutherford of England about this time showed that the diameter of the whole atom was about 100 thousand times that of the nucleus. Bohr of Denmark worked out the mathematics of the orbits of the electrons. In 1919 Rutherford, using radium, fired alpha rays (i.e., helium nuclei) at nitrogen atoms, and broke the nitrogen into oxygen and hydrogen. This was the crucial experiment in the discovery of atomic energy.

In the early thirties Urey of Columbia discovered deuterium (a component of heavy water), which later was found to be an excellent "atom-smashing bullet." Cockcroft, an Englishman, was the first to fire artificially-made protons at lithium, whereby he smashed the atom and produced helium. In the United States Lawrence devised the cyclotron—a massive apparatus in which increasing velocity is given to rotating nuclei, etc. About the same time Dempster of Chicago discovered U 235, a particularly valuable form of uranium. In 1937

Hahn and Meitner in Berlin smashed the uranium atom (which has 92 protons) into barium (56 protons) and krypton (36 protons). During this conversion some of the matter was changed into relatively enormous amounts of energy.

This was the period when Hitler was purging "Non-Aryans." His insane racial ideas drove out Einstein, Bohr, Meitner, the Italian Fermi, and many others of the greatest scientists of central Europe. When war broke out in 1939, both the Germans and the Allies were engaged in a desperate race as to which should first utilize the immense power set free when atoms are smashed on a commercial scale. The Allies pooled their resources, and decided to build the gigantic plants which were necessary in the United States. Pasco (Washington state), Oak Ridge (Tennessee), and Sante Fé (New Mexico) each had its mysterious plant. Uranium was obtained chiefly from the Eldorado Mine on the Arctic Circle in Canada, and Canada had several small plants engaged in atomic research.

German efforts were foiled by constant bombing of the plants, such as that at Ryukan (near Oslo) and others in various parts of Germany; and hence they had made little progress in this field when peace was declared.

On July 16, 1945, the first test bomb was dropped at Alamogordo in New Mexico, about seventy miles north of El Paso. The ensuing blast was felt for a distance of 300 miles. On August 6 the Japanese army bases at Hiroshima (400 miles west of Tokyo) were obliterated by a single atomic bomb. More than four square miles of the city were converted into dust, and over 100,000 unfortunate civilians died as the result of the heat and pressure waves.

It is too soon to evaluate the effect of this vast increase in scientific knowledge on our civilization. The writer is not so pessimistic as many publicists. He remembers the widespread fear of gas warfare, prevalent in the late thirties. Yet this dreadful weapon was not used throughout the six years of war. He remembers the predictions as to the dire possibilities of liquid air, today a humble weapon in the production of oxygen for welding. The cost of the atomic bombs has been immense amounting to about 2,000 million; and one hopes this will be a permanent deterrent. Professor Cockcroft, the leading English physicist in this field, has stated recently: "I think it will be a long time before

atomic energy will displace cheap Canadian electric power . . . or your Shipshaw power development."

Eleanor Roosevelt in 1945 sounded what should be the keynote of our attitude towards the discovery of atomic energy. "This discovery was made by the pooling of many minds belonging to different races and religions. The way the work was done sets the pattern for the way in which in the future we may be able to work out our difficulties—not by setting up superior races, but by learning to co-operate, and using the best that each one has to contribute to solve the problems of this new age."

CHAPTER XIV

LAND SETTLEMENT AFTER THE WAR: CONCLUSIONS

MIGRATIONS AND STAGES OF SETTLEMENT

THERE will be a considerable migration of peoples now that the conflict is over, though it is unlikely that this will rise to the figures which marked the maximum movements into the New World before the First Great War. These migrations reached nearly a million in each of the six years before 1915, as regards entries into the United States; while Canada received about 200,000 in each of these years. The general decline of the birth-rate throughout most of Europe has greatly lessened the drive to foreign lands; though this may be counter-balanced by a strong desire to get away from the possibilities of destruction in Europe, which have marked the last few years.

The most important concept in connection with the natural increase of population, is known as the survival rate; which is based on the number of mothers in a generation who survive to maintain the population. Among the north-west (Nordic) nations of Europe this survival rate is not sufficient. For instance England and Germany, according to Gini (1930), are 18 and 19 per cent short of the adequate number. Estonia, Sweden, Switzerland, and Austria also seem to be in a bad position; while Belgium, France, Finland, and Norway, though inadequate, are not so bad in this respect. The south-east European nations (largely of Alpine race) have populations where the supply of potential mothers is quite adequate. Indeed Roumania has about 35 per cent in excess, while Italy (20 per cent), Bulgaria (17 per cent), Spain and Russia, also belong to this satisfactory category. A map illustrating this vital distribution of European mothers was given in my book *Environment and Nation*,¹ and is reproduced as Fig. 92.

The problem of the supply of new lands still available for white settlement is one which has engaged the writer's attention for over forty years. Some recent research as regards available lands in Canada may be summarized in this chapter. It is amusing to find that I am

¹Toronto, 1936.

considered a dangerous optimist in some quarters in Canada; I hope my opponents are as much in error in the Dominion as they were in Australia, where my pessimistic views were held in contempt by all true-blue boosters until hard facts converted them.



FIGURE 92.—The dying-out of the Nordic race, and increase in the other races. The heavy broken line includes (to the north-west) the nations which are declining in population.

Let us first of all get quite clear in our minds the stages in the development of a pioneer land, using Canada as an example. There have been five main stages in this process, for which we may use the labels Fish, Fur, Forests, Farms, and Factories. In the east of the Dominion much of the country has passed through all five of these stages. It has been rashly supposed by some too optimistic writers that all the rest of Canada will pass through the same evolution. The stage diagram given in Fig. 93 should explain how this error has come about.

When Cabot explored the Newfoundland coast in 1498 he described the incredible abundance of fish on the Grand Banks. This soon led to an expansion of the fishing industry from the east to the west coasts of the north Atlantic. Within a few decades the fishermen began to barter their goods for the furs brought to the coast by the Indians. Tadoussac, at the mouth of the Saguenay, was settled by Chanvin as early as 1599, in order to collect such furs. After the French colony was well established, forest products, such as timber and potashes, became of increasing importance as exports to the Old World; though they did not rank with the fur trade for many a long year. Farming

naturally developed in the very early days, though all the products were used locally at that time. The first farm was perhaps that at Annapolis in 1605, near the east shore of the Bay of Fundy.

The lowest chart in the diagram in Fig. 93 represents the zones of industry in the eastern portion of the Dominion about 1750. Fishing is still important, but has been replaced to some extent by farming and by lumbering on those coasts adjacent to the St. Lawrence. The fur

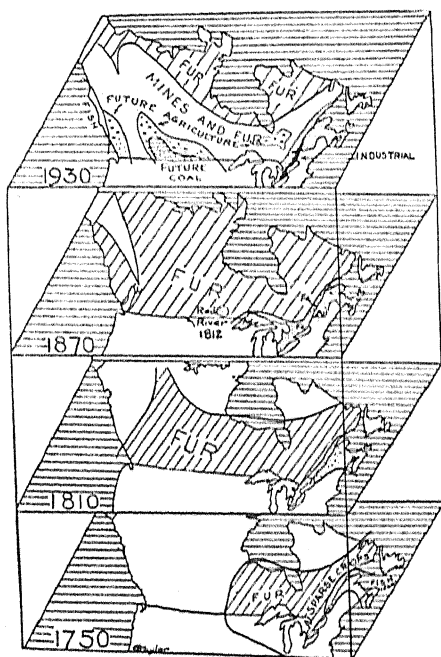


FIGURE 93.—A stage diagram of industrial development in Canada from 1750 to 1930. The five stages, Fish, Fur, Forest, Farms and Factories gradually move inland, but the north is unlikely to develop the two later stages.

trade has already migrated inland, to form a zone "pushed away" from its original position on the coast. In the next chart (for 1810) forest products are becoming of much greater importance than in the earlier stage. Squared timber from the Ottawa River, and elsewhere, is becoming an important export to Britain. The fur trade has been driven still farther to the west, and Mackenzie has opened routes to the Pacific and Arctic Oceans in the interests of this industry.

In the third diagram we see a further shifting of the zones. Fur is sought in every part of the Dominion. Forests are being cut even farther from the St. Lawrence waterway. Farms have spread over wide areas in the east and in Ontario. Factories are becoming of considerable importance in the chief towns of the east. Some farms have even spread into the far interior, based on Selkirk's colony in the Red River area about 1812.

The upper and last diagram (Fig. 93) is the most interesting, and shows the position of the zones at the present day. It is true that marine fishing is necessarily confined to the coasts, but some of the most valuable, i.e., the salmon pack, is done in the later-discovered waters of the coasts of British Columbia. In the pioneer belt north of Edmonton the export of whitefish from the inland streams is an important feature of the life of the Indians in that area, though furs are still their mainstay. Farms are now very important as far to the northwest as the Peace River and Prince George. The important industrial areas are found still in the older-settled east, being concentrated along the St. Lawrence waterway from Quebec to Windsor.

The chief point that I want to emphasize in this stage diagram is that these shifts will not continue much longer. In the east we have seen fish give place to fur, and then to forests, farms, and factories. It might at first glance seem logical to assume that the same evolution will occur at all other points in Canada; as for instance on the Coppermine River, where fish and fur are now being gathered by the few settlers on that empty Arctic coast. But the forests have very definite boundaries, laid down by nature without reference to human desires. The wheat farms of Canada depend on the climate and soil, and we know enough of these controls now to be able to give limits to our agriculture. Wheat will not proceed far into the taiga environment. Factories depend mainly on power, so that a knowledge of coal supplies and of water resources gives us definite bounds to these forms of industry also. We may sum up by saying that although the better parts of a new land pass through the "five F" stages, the marginal areas will probably never experience the later stages in this very general sequence of settlement.

PRESENT AND FUTURE AGRICULTURAL AREAS IN CANADA

A rapid survey of the present and future capabilities of a large country such as Canada can be obtained if we concentrate on the farm-

lands of the area. Metal-mining and pastoral industries do not in general lead to the spread of large populations. For instance, in Australia the population outside of the farmlands is only a few per cent of that included in the regions with a climate suitable for crops. Industrial populations of course are not necessarily anchored by the same climatic ties to the land, and they form a very large section of both the Australian and Canadian peoples. But it is a curious fact, which I cannot develop here, that such industrial areas are almost invariably found in regions with a good climate, i.e., close to farmlands. As I have mentioned earlier hardly any coal occurs in arid or tropical lands; and while water power occurs wherever rains are heavy enough, so far little has been used except in temperate lands.

We can therefore get a measure of the habitability of Canada by charting the areas where there is satisfactory temperature, rainfall, and soil for the growth of crops. We must not forget that although at present only wheat is a crop of major importance, yet there are other crops, notably barley, potatoes and other vegetables, and dairy hay, which can be grown a good deal north of the line at present accepted as the northern limit of economic wheat. An official map suggests that potatoes may be grown as far north as the Tundra boundary.

In the table below I have listed the total areas of the nine provinces, together with the areas of each under crop. In the third line appears the area which the Dominion authorities assign to future agriculture on lines now in practice. Later, I give a rough estimate of the areas whose climate is fairly satisfactory for the growth of the cold temperate crops mentioned above. It is at once admitted that only subsistence farming is likely to be possible beyond the present limits of the wheat belt. To many of the refugee folk of Europe such lands may become attractive, for the earliest settlers of Canada expected little beyond the barest subsistence from the farms they hewed out of the forests.

A few words must be premised regarding the great Canadian Shield. The writer, when in Australia, was under the impression that this formation, which covers about half of the Dominion, was essentially a region of rock covered with many small and some large lakes. On my first traverse I naively prepared to estimate the very small proportion which, I thought, was covered with soil and timber. In point of fact (south of the Tundra or Barren Grounds) almost the whole Shield is

covered with poor soils; and with a plentiful growth of spruce and pine, much of which is admittedly of only third- or fourth-class quality. The opinion of geologists who have wandered throughout this area is that less than 10 per cent is bare rock. The rest of it (south of the Tundra) has plentiful water, plentiful timber for fuel, plentiful water power most of the year, plentiful canoe routes and winter trails, plentiful, if poor, soils; and in most of it there is a short hot summer which gives a practical growing season for the humble subsistence crops outlined above. How different a picture is this from the condition of the Australian empty lands. There the absence of rain means that the other potential assets, whatever they may be, cannot enable a noteworthy population to develop there.

I have made note in all my journeys of widespread farms on the Shield; and as any traveller knows there is hardly a district along the ways without those few acres of farmland, which are omens of the population to come. Again I repeat that for a generation or two this will be farming of a lowly subsistence type. This naturally does not appeal to present-day farmers, who are not tempted to spend their lives opening up such poor country. But it is not barren land, and will someday become an asset to the Dominion; while the arid lands of Australia, as far as I can see, will never support aught but a negligible pastoral population.

AREAS OF GOOD, FAIR, OR POOR AGRICULTURAL LAND
(1,000 acres)

	British Colum- bia	Alberta	Saskat- chewan	Mani- toba	Ontario	Quebec	New Brun- swick	Prince Edward Island	Nova Scotia
Total areas	229,939	159,324	152,304	140,623	232,500	335,062	17,734	1,398	13,275
Present crops	520	14,328	21,919	6,997	9,156	6,104	908	505	556
Still avail- able	19,061	48,473	24,400	17,248	42,996	26,441	6,566	66	3,760

According to Mecking, potatoes can be grown where the summer temperature is around 50° F. This isotherm is shown on Fig. 94. It is immaterial to the potato crop how cold the winter may be provided there is enough warmth in the growing season. I have made a

rough estimate of the areas north of the present croplands but south of the isopleth 50° F. These tentative areas admittedly include all lakes, bare rock, and the large areas of almost pure sand which are all too frequent on the Canadian Shield. Still the totals of these extremely poor croplands are very large; and we cannot write them off as useless for another century or so. In the following table the areas are given in thousands of acres, mostly lying, of course, to the north of the areas in the western provinces.

POOR SUBSISTENCE AREAS WITH CLIMATE SUITABLE
PERHAPS FOR POTATOES
(1,000 acres)

In or Near	British Columbia	Alberta	Saskat- chewan	Manitoba	Ontario	Quebec
New areas south of line 50° F.	Too rocky	190,000	120,000	100,000	100,000	100,000

It is perhaps hardly necessary to state that this large area totalling 600 million acres (with a climate adequate for the growth of potatoes, etc.) will need three factors, lacking at present, before it becomes of any importance. These are: much greater population pressure, extensive drainage operations, and a very large supply of fertilizers. The latter point is worth a brief examination. (We know little about the soils.)

Possibly in the future, economic historians may describe the nineteenth century as characterized by the search for coal; the twentieth century by the search for petroleum; and the twenty-first century by the search for mineral fertilizers. There will never be any dearth of nitrates, since this vital plant food can be obtained from the air. But potash and phosphorus, especially the latter, are much more important to man than gold or diamonds. No plants (or animals) can live without them, and their supply is quite limited. The beds of Stassfurt in central Germany are the richest sources of potash, and there are others in the Carpathians and elsewhere. The oceans contain enormous quantities of potassium chloride, which will be extracted in the future, as it is from the salts of the Dead Sea today.

Phosphorus has been described as "man's weakest hold on the earth," for when its supply is done man will not survive. There is no immediate need for concern; but the price of phosphorus products is likely to rise sharply in the future. Natural guano is practically ex-

hausted, and "rock phosphate" is not very abundant except in the Rockies (Idaho, Montana, Utah) and in Florida and Tennessee. Tunis and the U.S.S.R. produce amounts comparable with those of the United States. Canada has somewhat similar phosphate supplies near Banff.

Another valuable source is the mineral apatite, which is found in small quantities in many granites. This has been mined in a small way in Ontario; but it is possible that extensive areas of "apatite syenite" may be found in our Shield, since it is now being exploited on a grand scale in somewhat similar rocks in the Kola district of northern Russia. I lay stress on this question of our fertilizer supplies, since it is much easier to fertilize well-watered poor soils with a few hundred pounds of fertilizer per acre, than to supply the plant needs of an acre of desert soil, however fertile, which requires about 1,800 tons of water to give the equivalent of fifteen inches of rain.

One of the chief functions of the geographer, as I have mentioned earlier, is to forecast where settlement will be profitable; and especially to indicate the order in which new lands should be occupied. For instance, in Australia, it seemed obvious to me that it was foolish to settle the poorly endowed agricultural land of the tropics, as long as there was much similar poor land available in the temperate areas. The tropical areas must wait. So also in Canada I do not want to see a settler in my hypothetical "potato lands," until the vast areas of better second- and third-rate land to the south are exploited.

I have published several maps which stress the order in which the empty lands of Canada should be occupied, and one of these is reproduced as Fig. 94. It is taken from a small brochure entitled "Canada's Role in Geopolitics."² I cannot do better than quote from this booklet.

The fringe-like character of the Canadian population is well brought out in Fig. 94. Here we see a line labelled 2, 2, 2, 2, 2; this is the isopleth of two people per square mile; and it bounds on the north all the important population of the Dominion. The three densest areas are, of course, around Montreal, Toronto and Windsor, where considerable districts contain more than forty-five persons to the square mile. These are not, however, specially designated on the map. The largest area of fair population is the newly-settled prairie region. Here the extensive supplies of Alberta coal will, in all probability, produce the

²Canadian Institute of International Affairs, Toronto, 1942.

densest Canadian population of the future. This most important and little appreciated asset of the Dominion will be described in a later section of this chapter.

The three main divisions of Canada, as has often been pointed out, are topographic. They comprise the Shield in the east (shown by close ruling); the relatively level area of the Prairie lands, with their

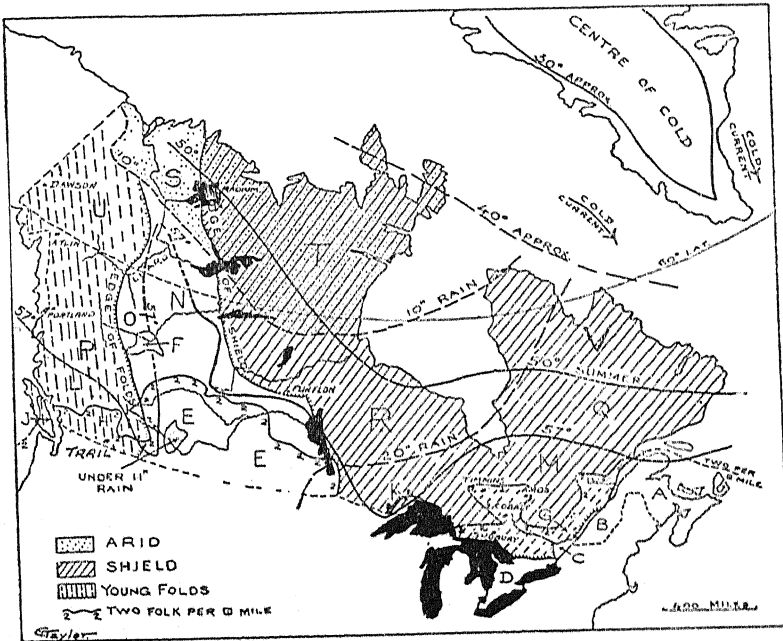


FIGURE 94.—Canada sub-divided to show the order in which the lands should be developed. The line marked 2, 2, 2, 2, is where the population is two per square mile. Northern Alberta is seen to be the most promising field. Note the importance of the 57° F. summer isotherm. (From *Environment, Race and Migration*.)

extension of somewhat similar formations along the Mackenzie River almost to the Arctic Ocean; and lastly the complex series of folds and uplands which together form the Rockies and the Coastal Ranges of the Yukon and British Columbia. These latter are shown by broken lines.

The soils of the Shield are poor and badly drained, as we have seen. There is however a vast area of lake silts (laid down in the glacial age

in vast vanished glacial lakes) which is generally known as the *Clay Belt*. This is indicated in Fig. 95, and may contain twenty or thirty million acres of better soils on the borders of Ontario and Quebec.

The best of the three terrains is, of course, the second of the three just mentioned, i.e., the *Prairie lands*. In the third major region the land available for close settlement is confined for the most part to the lower portions of the various basins (such as that around Prince George), or to the terraces along the rivers in the narrower valleys of the interior. Unfortunately much of this region with a reasonable temperature is very dry, some parts receiving less than seven inches a year, as near Clinton. The large delta of the Fraser River contains about half the total population of British Columbia; and it is worth noting that the croplands of this huge province are no more extensive than those of tiny Prince Edward Island.

Perhaps the most vital isopleth for Canadians is that showing the summer temperature around 57° F. This is charted approximately in Fig. 94. It includes only the southern coasts of Newfoundland; runs well north of the Saguenay, through Moosonee, and across to Fort William. Here the line swings north-west nearly up to Norman, near Great Bear Lake. The cold ranges of the Rockies produce a "cold loop" extending south to the border; but in British Columbia it again runs to the north-west to the coast somewhere near Prince Rupert. (Owing to the lack of weather stations, these isotherms are only approximate.)

In the following table I have classified the score of regions (A, B, C, etc., to V) in four groups. In group I are all the districts which today have over two people per square mile. We may be sure that they are the most attractive. The presence of valuable minerals has of course hastened settlement in certain areas, such as that around Timmins. This great gold-mining district lies in the *Clay Belt*, and the farmer here is admittedly faced with many difficulties. Bad drainage, summer frosts, difficulties of transport, distance to markets, the poor character of some of the settlers: all these disabilities have to be overcome. But they are all inherent in a "pioneer fringe," and have been conquered in other lands. I have included this *Clay Belt* in group II in the table.

Of much the same pioneer character are the lands labelled N to the north of the region now being occupied in the Peace River block (F in Fig. 94). These are being investigated by agricultural experts, and those interested may consult the numerous papers by W. D. Al-

bright.³ Professor Leppard also gives a good account in the *Geographical Review* for 1935;⁴ and the same number of this journal includes a valuable discussion of the Canadian pioneer fringe by Professor H. A. Innis, with eight maps.⁵

The regions labelled O, Q, R, and S, are those already briefly discussed as offering possibilities in the distant future for a poor subsistence type of farming. T, U and V offer no possibilities of settlement except mining, fur-trading, and perhaps in the long run some very sparse pastoral occupation, based on reindeer and muskoxen, of the type advocated by Stefansson.

GRADES AND ORDER OF DEVELOPMENT OF LANDS IN CANADA

Classification	East	Centre	West
I. Over 2 folk per sq. m., and S. of 57° F.	A, Maritimes B, C, D, St. Lawrence G, Taiga* (mines and pulp)	E, Prairies F, Mid Peace R.	H, Okanagan J, Vancouver, etc.
II. Potential settlement S. of 57° F.	M, Clay belts in the taiga	N, Athabasca-Liard taiga	I, Upper Fraser to the coast
III. Poor subsistence farms of future	Some in M	R, and some of Q and S	Some of P
IV. No notable settlement except mines	V, and some of Q	T, and some of R	U, and some of P

*Taiga is the belt of coniferous forest.

COMPARISONS OF CANADIAN AREAS WITH HOMOCIMES IN EUROPE AND SIBERIA

In 1936 I published a map (Fig. 95) in the *Canadian Geographical Journal* which seems to me to demonstrate that it would be foolish to think that the population of Canada will remain near the present figure of eleven millions, in view of the need for new lands on the part of increasing populations elsewhere. In this map I show, to the same

³See, for instance, "Crop Growth in High Latitudes" (*Geographical Review*, Oct., 1933).

⁴"Peace River Country" (*Geographical Review*, Jan., 1935).

⁵"Canadian Frontiers of Settlement, a Review" (*Geographical Review*, Jan., 1935).

scale, certain large regions in Europe, which in the aggregate support over 100 millions. I do not suggest that the comparisons are more than a first approximation; but any geographer will admit that there is, for instance, much in common between the lands of southern Norway and those of British Columbia. In the former is a population of three millions, whereas British Columbia has less than one million.

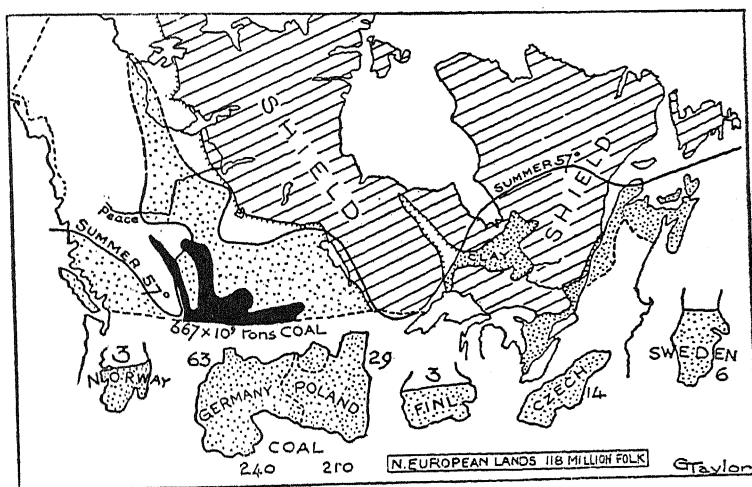


FIGURE 95.—The pioneer lands of Canada compared with areas of somewhat similar environments in Europe, which support 118 million folk. The coal of Alberta (shown black) is more abundant than that of Bohemia, or the Donetz region; however, the figure 667 should be 46. The figure 210 for Poland is an earlier estimate than that given on p. 322.

The total amount of coal in Alberta until lately was said to equal 667,000 million tons, which is only surpassed by the resources in the northern Rockies of the United States. Unfortunately recent estimates reduce this large figure to 46,000 million tons, i.e., about that of Bohemia. Every reader knows that the population of Germany and Poland is to a large extent based on their large coal supplies, and on the factories dependent thereon. The total supplies of Germany and Poland are said to be about 450,000 million tons. These two countries are not very different from the Canadian prairies, though the climate of Germany is wetter and much less continental. However the combined population of Germany and Poland is about ninety-two millions. The environment is not unlike that of inland Canada south of the summer isotherm of

57° F., to which reference was made in the last section. Today the three prairie provinces have a total population of less than three millions; truly a considerable departure from the ninety-two millions based on the coal and crops of Germany and Poland.

Finland is a country with a climate not unlike that of the Clay Belt, which is indicated in Fig. 95. There is little population in the north of Finland, but the south contains three millions. At present in our Clay Belt the population is negligible. Sweden with its six millions is to be compared with our Maritimes and adjacent Quebec, where indeed the discrepancy is not so great; since the Canadian area supports three millions. As regards the best part of Ontario and the Montreal region, it is not unlike Czecho-Slovakia in its agricultural aspects, though the coal supplies of Bohemia give the latter greater industrial power probably than our large hydro-electric supplies. However the Canadian region has less than half the population of the fourteen millions of Czecho-Slovakia. This brief discussion serves to focus the attention of Canadians on the assets of the prairies, which are probably greater than those of older-established eastern Canada.

No principle of geography, as applied to Canada, is more important than that which teaches us to watch carefully the research and projects of the Soviet Union. Their problems are in large measure our problems. I have tried in Fig. 96 to show the similarity of the two vast regions. The climatic data are not very well known, while soil surveys are absent in most of the vast areas. But, as a first approximation, we can see fairly clearly that Russia has large areas with reasonable rainfall and with temperatures above 56° F. in July; much as we have seen is the case in Canada. These areas are shown to the same scale in Fig. 96.

The population of the Soviet Union is 170 millions today. Somewhere about fourteen million Russians have settled in Siberia in the last thirty years; for the western portion of Siberia is becoming a vast farming area, with a large export of such products as wheat, butter, and meat. I have added to the map of Siberia the isopleth which shows where the population exceeds sixteen per square mile. (It is labelled 16 P.) In Canada this line at present would include only regions C and D, and the western half of B in Fig. 94. These are too small to be shown on the map of Canada in Fig. 96. Yet I expect the density-lines to spread in Canada in the future much as they have done in Siberia.

The Russian birth-rate is very high, which is of course a factor that does not depend directly on geographic controls. Some of their pub-

licists confidently expect a population of about 340 millions by about the year 1975; though the recent war may considerably modify this figure. What I wish to point out is that Canada, which appears to have about half the Russian area of "potential-settlement" country (shown

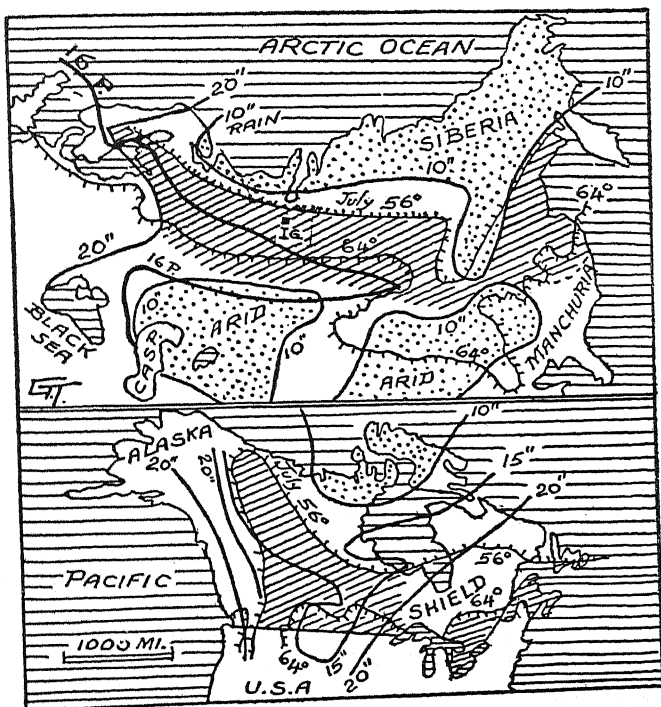


FIGURE 96.—An attempt to compare future settlement in Canada with that of the U.S.S.R., where a population of over 300 millions is likely to develop. Regions ruled diagonally have similar conditions of fair rainfall and temperature in both countries. Notice the heavy line (16 P) in Siberia, with over sixteen folk per square mile. Dotted areas are arid. IG is Igarka.

ruled in Fig. 96), cannot possibly be "saturated" with a population of only eleven millions.⁶

The writer has been publicly denounced for encouraging such

⁶The map at the end of *Limits of Land Settlement*, New York, 1937, gives a much smaller proportion to Canada, but includes none of the hypothetical "potato lands."

optimistic ideas as to the future population of Canada; for it is stated that we have an unemployment problem in normal times, and such new jobs as are going are only enough for the needs of our own youngsters. My opponents will find that there was a considerable amount of unemployment in England during Plantagenet times, yet the population of England has not failed to grow enormously since that distant period.

I do not venture to suggest how much we should expect the population of Canada to be, merely by glancing at these two similar-scale maps. The U.S.S.R. offers the world's best example of scientific colonization based on scientific planning. There are dozens of scientific commissions doing geographical work of this kind all through Russian Asia. In Canada, as far as I know in 1943, no scientist trained on modern geographical lines is working on any government planning. In the United States during the recent emergency I heard of a call for 700 trained geographers for one purpose or another; in Canada I find no practical interest taken in modern geographical training by 99 per cent of the government or school authorities.

One centre of geographical research in Siberia deserves special mention, and that is the new polar town of Igarka. George Cressey gives a very valuable account of central Siberia in his study *Pioneering in Yeneseiland*.⁷ Igarka (IG in Fig. 96) is in latitude 68° near the mouth of the Yenesei, and is far north of the Arctic Circle. He writes much as follows:

Igarka is the magic city of the Siberian Arctic, and the pride of the Northern Sea Route Administration. Although 400 miles from the open ocean this is the chief port of the Yenesei. In 1929 it was a settlement of one house and three natives; by 1937 it numbered 15,000. The main dock is 720 metres in length, and visiting boats are as large as 7,700 tons. In 1937 no less than 21 foreign boats entered the port to export the timber of the hinterland. The older part of the town has the city hall, fire department, opera house and club; while the newer city has the port, aviation headquarters, hotel and theatre. On an island across the harbour an extensive farm started in 1932. Root crops, such as potatoes, turnips, beets and kohlrabi, are grown in open fields; and cultivated ground in 1937 amounted to 80 hectares. In the vicinity are 400 cows, 360 large white English pigs and numerous horses.

We in Canada have our own pioneers at Aklavik in a similar situation at the mouth of the Mackenzie. What can be done in northern Siberia can later be done in northern Canada; and it is fortunate for us

⁷Denison University, Granville, Ohio, 1939.

that the Russians are making experiments, on a scale beyond our range in Canada at present, from which we also can benefit.^{7a}

RELATIVE ADVANTAGES OF THE NEW LANDS OF THE WORLD

Many years ago, during my research in Australia, I made a rather elaborate attempt to forecast the totals of white population which might ultimately settle in the chief pioneer lands of the world. My method was, I think, rather novel; and had one merit, that it used the present population of Europe as a check on the possibilities of the new lands. Hence, before describing my comparative method, it will be advantageous and, I hope, interesting to consider how the population pattern of Europe has developed.

I do not see how anyone can contemplate the very definite pattern of the population of this oldest collection of "white" nations, and not become a convinced "environmentalist." (Yet many of my geographical friends remain "possibilists," so that I fear my arguments are not quite as strong as they seem to me!)

What is the purpose of studying European history? Surely one main reason is to see how the nations of Europe have become grouped into the very definite pattern which is apparent in Fig. 97. European history traces the rise of the Roman Empire with its many colonies, and the folk-wanderings with the transfers of whole nations. It discusses the conquests of soldiers like Caesar, Charlemagne, Saladin, Suliman and Napoleon. Yet it is almost impossible to find any trace of the changes which they brought about in the European population pattern of today, which is perhaps the most characteristic result of social development. Far more significant are the controls summed up in the word *environment*. Build, temperature, rainfall and coal dominate Europe today; and to them alone is due the significant distribution of the peoples of Europe.

In the main map in Fig. 97 is given the varying density of the peoples of Europe: from the black patches which contain more than 512 people to the square mile, to the widely spaced dots, which indicate densities less than sixteen people to the square mile. The major environmental controls appear in the three small maps at the side. A shows the chief temperature and rain controls; B shows the rugged mountains around the Mediterranean, and the relic plateaux. (These topographic

^{7a}See the author's memoir, "A Mackenzie Domesday: 1944" (*Canadian Journal of Economics and Political Science*, May, 1945).

features are better shown in Fig. 84). In C the three main units of the build are given; the shield in Russia, the belt of coal basins north of the Alps, etc.; and the ancient Tethys Sea, which ultimately was upheaved to become the young mountains of the Alpine Storm.

The sparsest areas are in the north and are numbered A1, A2, and A3. Clearly they are an expression of the climate, for they are precisely those which are labelled "too cold" in the small top inset map. They are in fact the realms of "King Frost," who has resisted all invaders. In the south-east and south are the lands of "King Drought," which are labelled B, E, and F. The remaining sparse patches are G and G2, and

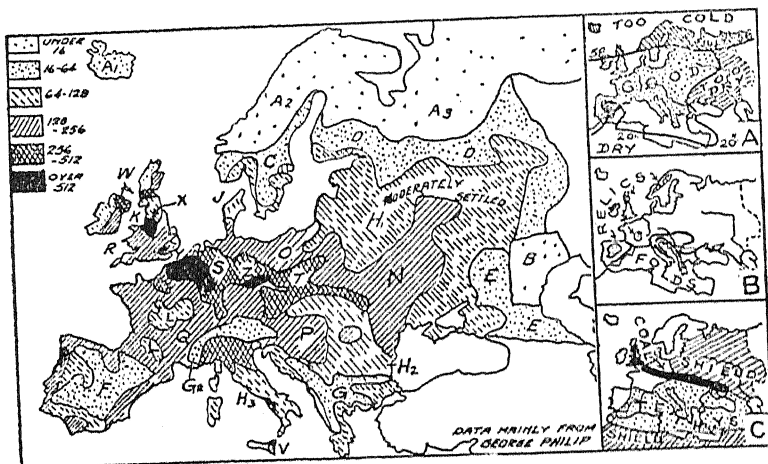


FIGURE 97.—The present population pattern of Europe, which is dependent on the controls shown in the inset maps. A. Climate; B. Build; C. Tethys Sea, coal, etc.

these are determined by the rugged mountains as shown in the middle small map. The remainder of Europe has a good climate, neither too cold nor too dry, and is accordingly somewhat densely populated.

The areas of densest population, with one exception in north Italy, extend from central Scotland to the Black Sea. They are labelled S, T, W, X, Y, Z. It will be seen at a glance that these are in the realm of "Old King Coal." The coal belt forms the black strip which runs across the middle of the small map at the bottom right. Thus the environmental conditions of 200 million years ago, which produced the coal flora, are accountable today for the most striking feature of the population pattern of Europe.

It must be noticed that these major environmental controls run right across the national boundaries. The presence of coal or of semi-desert grasslands is a stronger factor than are any controls brought about by human cultures or technology.

AN ESTIMATE OF WORLD HABITABILITY IN TERMS OF EUROPEAN DENSITIES

One of the most important estimates of the future food supplies of the world is that given by the well-known geographer O. E. Baker in 1923.⁸ It is especially valuable since it shows how aridity, frost, and rugged topography make large parts of the earth unlikely to be of much value to mankind.

There are about fifty-two million square miles of land surface, excluding polar lands; and of these he thinks that only about nine million square miles are satisfactory for crops. Somewhere about half of this is fairly fully exploited; so that at a rough estimate the final world population will be of the order of 4,000 millions.

ARABLE LANDS OF THE EARTH
(Million square miles)

Lands	Tropical and Subtropical	Temperate
Too arid for crops	8.0	7.6
Too cold for crops		6.4
Not arable (too rugged, etc.)	10.0	10.0
Pasture, but arable	0.6	1.5
Cultivated at present	1.2	2.5
Potential arable	3.2	1.0
Total land area	23.0	29.0

A year or two before this table appeared the writer had made a more detailed study of the possibilities of the land surface of the world, which he divided into seventy-four more or less homogeneous regions.⁹ First of all he published what seems to have been one of the first world maps in which the isotherms represented actual temperatures (i.e., they were not reduced to sea level). Then he showed how the densities of population in Europe responded to temperature and rainfall, by drawing graphs with these factors as the ordinates. In Europe, the optimum

⁸Geographical Review, Jan., 1923.

⁹Geographical Review, July, 1922.

temperatures seemed to lie near 55° F. (see inset in Fig. 98); while the most useful rainfall was about 50 inches. The effect of a large coal supply was investigated by comparing adjacent regions, one with coal and factories (plus farms), and the other with only a farm population. Roughly speaking, the coal doubled the population density. Another line of research investigated the effect of plains and plateaux, etc., on density.

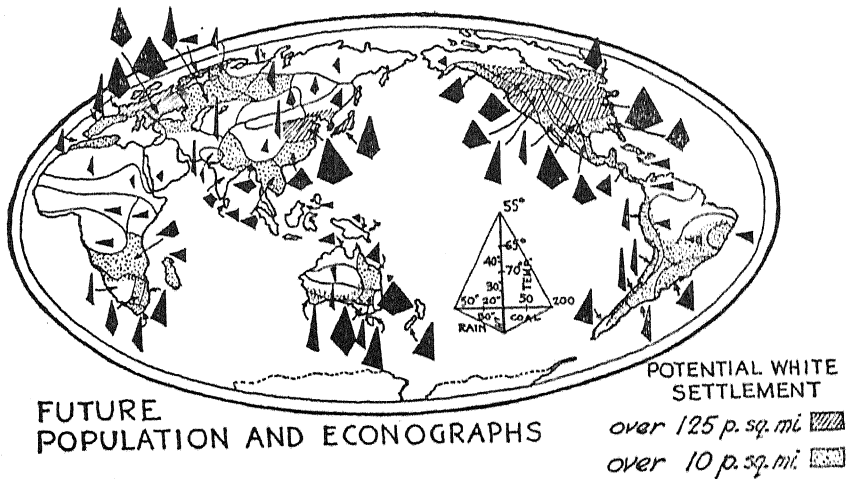


FIGURE 98.—The world divided into seventy-four homogeneous regions, for each of which is constructed an Econograph according to the plan shown on a large scale in the inset. The bigger the graph the better the region for settlement.

I thereupon constructed a graph (econograph) for each of the seventy-four world regions. In this graph distances along the axes were laid out according to each region's assets in temperature, rainfall, coal and topography. This gave a four-sided figure, and the seventy-four resulting graphs are shown (in place) on the world map in Fig. 98. In this map one graph is enlarged (drawn in the Pacific) to show the maximum possible area, i.e., for a region which has all the attributes at their maximum. Reasons for varying the importance of the four axes are given in the original paper. Here also it is shown that the areas of the graphs give a measure of the resources.

It will be seen that only the econographs dealing with the regions

around Britain, north China and the eastern United States have the optimum area. Many others lack a well-developed right side to the "kite," which means they have no coal; as for instance around Buenos Aires. Others are attenuated, as in all the deserts, meaning that the horizontal (rain) axis is very short. Still others are too cold or too hot, and these conditions produce "arrowheads" flying to the west as in the tropical jungles of Africa.

Among the seventy-four econographs are eight or ten referring to Europe. We know what are the densities of population in Europe under present conditions of living and of relative "saturation." It is a simple matter to compare the econographs of Europe with those of other parts of the world; and to assign to the areas, say of Australian regions, the population density values just ascertained for Europe. The two small legends at the base of Fig. 99 show (on the right) the population values to be assigned to the varying area units (on the left). Having obtained these potential population densities, it is a simple matter to plot the potential populations on a world map, and draw isopleths through the hypothetical figures in the usual way. Such a map with future population lines appears as Fig. 99.

It necessarily agrees with the map given in Fig. 9; but India in the former map does not appear as a centre of great population. This is because we are dealing with *white* settlers, and with populations which would develop with European settlers. They would not thrive in India, which accordingly is nearly blank. It is to be noted that a fairly dense population of white settlers on European standards, is shown in China. Here whites would do well enough; but of course there is no room for them, since the region is overcrowded with millions of Chinese, etc. Indeed the whole area enclosed in the heavy black line in Fig. 99 is out of the picture so far as future white settlement is concerned, though I have inserted the population lines for comparison.

Measuring the areas involved, and multiplying such areas by the potential population densities, we obtain some idea of the populations which can be supported in these new lands. Assuming the rather low standards of living which obtain in Europe in general, and which are far lower than those found in Canada, the United States or Australia, we get figures somewhat as follows for the lands in which we are most concerned.

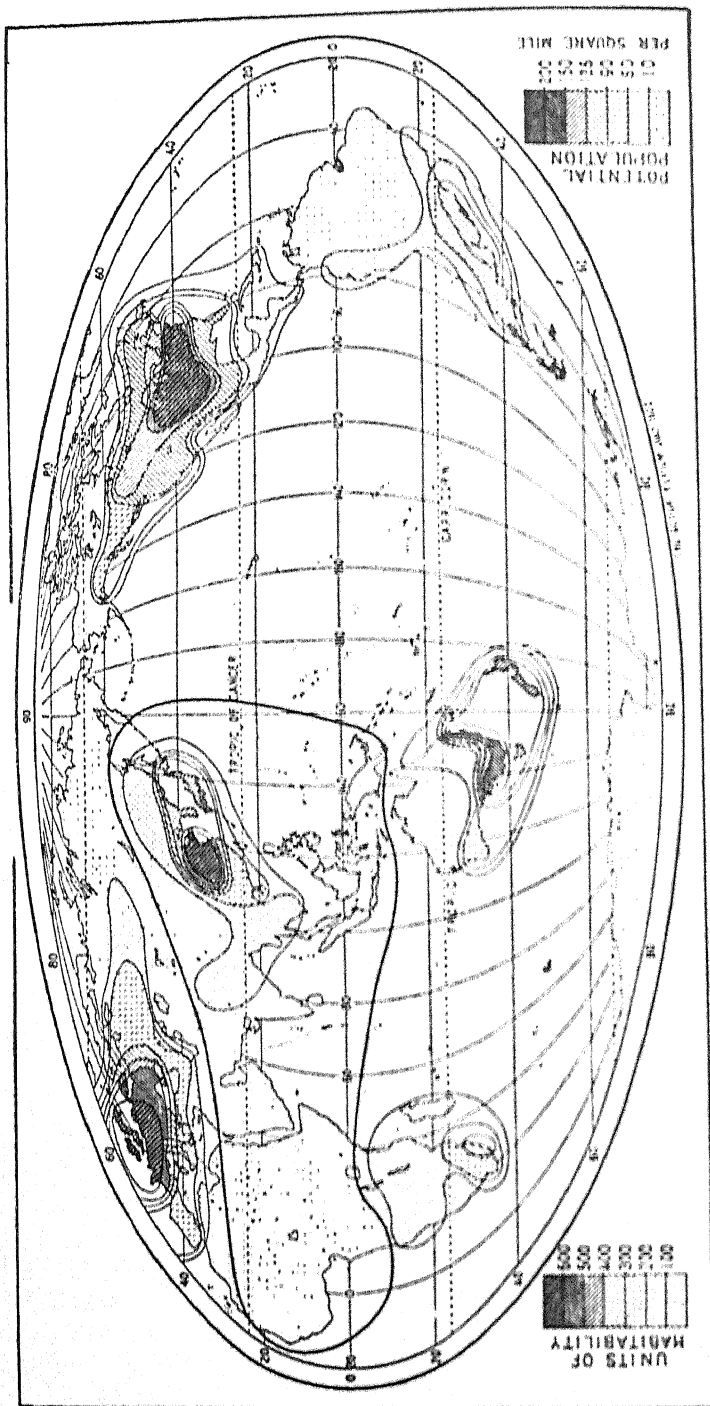


FIGURE 94.—The distribution of land with settlement according to the economic value of the world regions. The area within the heavy black line is not available for white settlement. The units of habitability are derived from the graphs shown in FIG. 93. The corresponding potential population is charted in the legend at bottom right. The potential population of southern Siberia is greater than is represented here, since the original map was drawn in 1921. (Geographical Review, July, 1922.)

FUTURE HYPOTHETICAL POPULATIONS

Europe (accepted as standard, and "saturated")				500 millions
Canada	100 millions	Australia		60 millions
United States	500 millions	Siberia		200 millions
Argentina, etc.	100 millions	South Africa		80 millions

In my original estimate in 1922 I did not, I think, make enough allowance for the poor quality of the Canadian Shield. Nor at that date did we know much about the enormous mineral resources, especially the coalfields, which are now found to be present in Siberia. Still the final map gives one some idea of the relative values of the empty lands of the world.

The data deduced in this research on future population are so often quoted inaccurately, that I may be excused for commenting on them further. First the hypothetical millions are not reckoned on the American, but on the much lower *European* standard of living, say one-half or one-third as costly as the present American standards. If we prefer to keep the present standards, our potential 100 millions for Canada is at once halved.

Around 1914 before the great wars, the population of Canada was doubling in about thirty-seven years. If this rate is maintained after the peace, then Canada would reach fifty millions about the year 2030. Furthermore we must remember that the Silesian farmer in Germany farms forty acres successfully; while the Canadian farmer (under somewhat similar conditions of climate in Manitoba) needs 400 acres, since he is living in the pioneer stage. But there is little doubt that in the distant future his farm will be cut up into smaller blocks.

The great populations of central and north-west Europe are based on exploiting the coal for fuel and power. We must some day use the extensive coal resources of Alberta, which are hardly touched as yet. Thus in the distant future, if we decide to lower the standards (which I do not advocate), to split up the large farms and to develop the coal to its utmost; then a figure of 100 millions seems to the writer to be not altogether visionary.

THE COMFORT FACTOR IN FUTURE POPULATION MOVEMENTS

An outstanding feature of the population of the most cultured nations is the rapid increase in the proportion of old people. Thus in Australia in 1871 only 2 per cent of the population was over 65

years in age. In 1921 it was 4 per cent, and in twelve years (1933) it had jumped to 6 per cent. In another generation we shall find a number of regions—as is already apparent in California—where the older folk are in much greater proportions than elsewhere, because such regions are blessed with a particularly comfortable climate. It is neither too hot nor too cold during most of the year, and so is found very attractive by folk who have retired from an active life; as well as by tourists and wealthy folk who perhaps do not spend the whole year there.

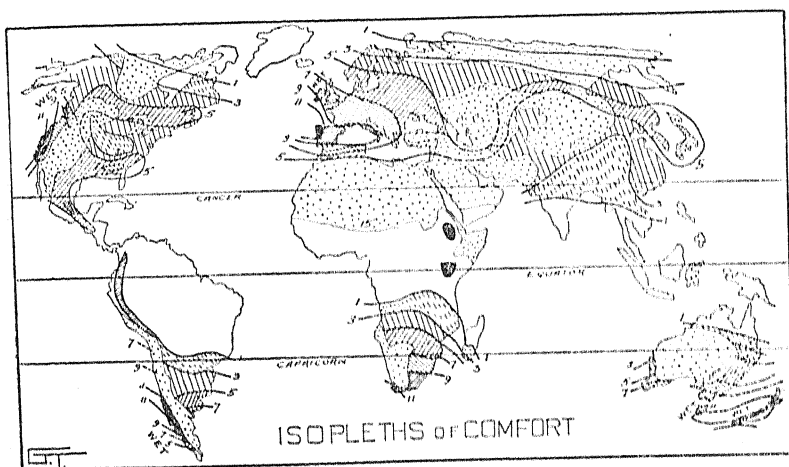


FIGURE 99a.—A tentative chart showing the number of comfortable months (average temperature between 45° F. and 65° F.) on the various "isotherms," i.e., isopleths of comfort. Arid areas (under fifteen inches of rain) are dotted. Regions of heavy rain are labelled "wet."

In Fig. 99a the writer has constructed a map which picks out such regions of continued comfort through the year. He has chosen a quite arbitrary criterion, which may not suit some of his readers particularly well. At any place the number of months whose means lie between 45° F. and 65° F. is charted; and each is called a "comfortable month." San Francisco is found to have twelve of these "comfortable months"; and this district seems to be the best in North America. In Europe the similar western coasts are very attractive, the best being the Scilly Isles and Portugal to the south. In Asia there is no very attractive area, though parts of south-west Japan have six or seven such months. The

isopleths on the map may be termed isoterps, from the Greek *terpein* "to enjoy oneself"!

In the Southern Hemisphere the lands are very narrow just where conditions would naturally be best. The plateau of South Africa has attractive temperature conditions, and Capetown is close to the optimum. New Zealand is very attractive along the coasts, but so much of the region is mountainous that the total area of optimum climate is small. The same remarks apply to southern Chile. Here also the temperate lands in the south-east are too arid for optimum conditions. Some areas with comfortable temperatures are very rainy. They are labelled wet.

High plateaux near the Equator have continuously pleasant temperatures, as at Quito (Ecuador), and in much of Abyssinia and Kenya. The great extent of pleasant climate in Europe is the most noticeable feature of the map. We may safely prophesy that south-east Australia, New Zealand, Capetown and southern Chile will join the western Mediterranean and California as noteworthy tourist and retirement areas in the near future.

SOME GEOPACIFIC CONCLUSIONS

I have nearly finished my survey of the long story of human progress. We have gained some idea of the population distributions in the next century. Of the four great centres shown in Fig. 9 only one is going to change greatly, and that is the North American unit. The United States will naturally remain the dominant partner. In the Far East it seems likely, now the Chinese have awakened to modern progress, that their 400 million nationals will take the lead from the seventy million nationals of Japan. The latter had their chance to produce a real "co-prosperity," but have lost the chance through their absurd claims to be the *Herrenvolk* of Asia. We may hope that India will soon have that measure of home rule which will reconcile it to remaining in the Empire. Surely the present war will have taught them to be grateful for the protection of the British, however the latter have delayed to recognize their growth toward self-government. Thus Britain will retain the dominant position in one of the four units for a time.

What is to be the position in the European power bloc shown in Fig. 100. If the Germans had remained satisfied with the slow but definite progress towards rehabilitation which they were making under

the Weimar Republic, they would almost certainly have dominated Europe. Their numbers, industry, scientific advances, and above all control of the Ruhr coal, would have enabled them to press further and further ahead of any rival. They have lost their chance—for a generation or two at least—and it seems clear that the U.S.S.R. will be the dominant member of the European family. It is of course quite possible that Russia will have all she can manage in exploiting the huge Siberian territory, which will leave Britain in a more dominant position in Europe. Be it understood I am not talking in terms of *national expansion*, which Britain has long ceased to desire; but rather of the industrial and cultural leaders in the various blocs.

One wonders whether we shall soon have a dominant world language. French has departed, while Spanish is vital only in less important parts of the world. Chinese enters very late; and it looks as if Russian were the sole challenger of world-wide English. Would that some authoritative "council of the Englishry" would modify the main absurdities in our spelling, for English has such simple syntax that it deserves in that respect to become the world language of the future.

It is evident that the Colossus of the U.S.S.R. will receive great attention in future world politics. It has one great asset, in which it resembles the United States, that its lands are all compact and in one unit.¹⁰ Far otherwise is the British Empire, which is scattered widely throughout the world. However, this very scattered distribution gives the British a very different outlook from that of the Russians, and, it may be, will help to keep two of the leading nations from dangerous rivalry. England depends on sea-borne trade of the widest kind. Russia will be more interested in her internal trade, as was the case with the United States in her formative years.

In the last diagram (Fig. 100) in this book I show the relations of several of the leading national units. The British Empire is seen to be arranged as a sort of crescent around Africa; so that long wings extend up the Atlantic to include Canada, and up the Indian Ocean to include India and Australia. Lying within the wings of this crescent are the lands of the Axis nations, Germany, Italy and Japan. In a solid block in the middle of the crescent is the empire of the U.S.S.R., with a vast

¹⁰The expansion of the Slavs is discussed as a world problem in pp. 168-9 of my *Environment, Race and Migration* (1937); and in p. 127 and Fig. 31 of my *Environment and Nation* (1936).

area of central Asia (shown dotted in the map) which is so far not under the control of any European nation.

Speaking in geopolitical terms, it would seem evident that the lands of unrest—the Axis nations and the somewhat unsatisfied Asiatic nations—are entirely within the grasp of the British and Russian powers. It is to

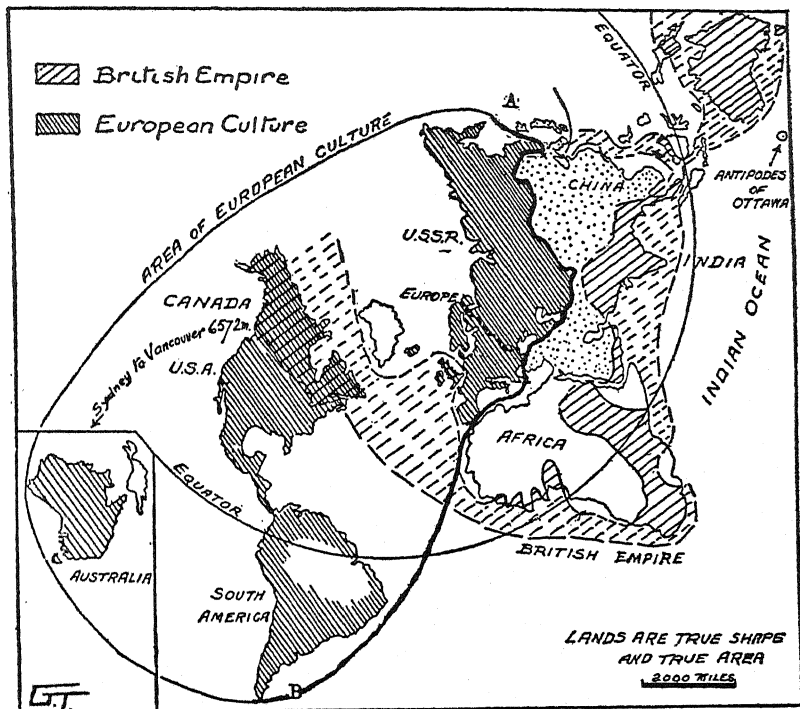


FIGURE 100.—A world chart to show the British Empire as a "zone" about the Old World. It is shown by open ruling. Notice the central position of the compact area of the U.S.S.R. in regard to the British Empire. Canada is seen to be the central area in a group of lands with "European culture" extending from Siberia to Australia. The dotted area is mostly under Asiatic control. (From the author's *Canada's Role in Geopolitics*, Toronto, 1942.)

be hoped that never again shall we have a world war; but what I wish to suggest is the paramount importance of Britain and the U.S.S.R. acting as police in the Old World, for which their key position eminently suits them. Even more important is it that Britain should make every effort to understand the Soviet peoples, to sympathize with their

aspirations, and to keep the peace with them. If we can do that the world is safe, for the remaining group, the Chinese, have always shown their good sense by abhorring imperialistic wars.

One very important cultural boundary is indicated in Fig. 100 by the heavy line AB. This marks what may become a more vital line of cleavage than the racial or national boundaries in the past. It separates those lands (on the left) which are being developed almost entirely in the "European tradition," whether English, French, Spanish, Portuguese or Russian, from those (on the right) where the majority of the peoples have a non-European culture. (Australia has been represented in the left-hand group in this concept.) The distinction may become one of low economic standards versus high economic standards; and unless the more progressive regions are careful, this may develop into a world struggle (based on under-selling and tariff walls) as acute as any that has gone before. As a geographer I have no panacea to offer for this "coloured peril," save fair dealing as indicated in the Atlantic Charter, and a world-wide interest in the new "Geopacifics"!

The distribution of these lands is what is interesting at the present juncture; for we see that the eastern portion of North America—the fourth of our power blocs in Fig. 9—is farthest removed from the boundary of conflict. Of these blocs the Sino-Japanese is likely to be favoured by the cheapest efficient labour, when the 500 millions involved are all moderately educated. The Indian bloc is likely to be the chief centre of unrest, since here for a time British interests are likely to be opposed to those of the native Indian workers. The European bloc—which may in the future extend as far east as the Tungus coalfield of central Siberia—will perhaps be in the best position with its high state of intelligence, and yet somewhat less exacting standards of living than America. However it will have the disadvantage of being much nearer to the chief competing non-European masses. The North American bloc may be expected to maintain its lead by virtue of the best education and the greatest technocratic developments. It seems unlikely that the centres of the Southern Hemisphere (near Sydney, Buenos Aires, and Johannesburg) can ever compete in a geopacific sense with the four major economic blocs just enumerated.

THE SEVEN AGES OF MAN

What are the salient features which emerge from our survey of man's progress from Eolithic times to the present? We may classify them in

seven divisions, each of them tending to occupy less and less time as man progresses, for the tempo of cultural evolution is rapidly accelerating, as was suggested in our early chapters.

The First Age we may call that of *Homo pre-sapiens*, using this term to link Neanderthal man and his predecessors. (Note however that the writer doubts if there is any biological break after Neanderthal man.) In this age man was little better than brute beast, though he had learnt to use fire and crude tools. But he had no claim to be labelled civilized man. We know little of his cultural ideas, but he had already begun to plan and perhaps to make crude records, though none has come down to us. This period may have lasted a million or more years.

The Second Age was that of the *Racial Differentiation*, when the migrations of numerous primitive people occurred, from the central breeding-ground of southern Asia. These types, from whom modern races are more directly descended, did not reach western Europe much before 10,000 B.C. But we may be sure that they had been evolving far to the east for many thousands of years before that date. Perhaps 100,000 years is not too long for the whole evolution of this stage of human culture. Some slight population pressure is developing and the migrations have taken place in accord with that arrangement of land and sea, and of attractive and exacting climates, which we have discussed under the name of the "Tri-Peninsular World Plan." In this period man's movements and evolution depended to a large degree on the distributions of open woodland, and were marked by the beginnings of agriculture. Nature offered him a higher stage than that occupied by *Homo pre-sapiens* in the pageant of civilization, and man gradually became trained to follow this more complex way of life.

The Third Age perhaps occupied the period until the time of the Dark Ages, say from 10,000 B.C. to A.D. 400. The most primitive races, driven on by the Alpine races of central Asia, had spread into the kindly European environment, from the more extreme conditions of the continental heartlands of Turkestan, Syria and Egypt. He had learnt how to use the sea-ways, and the horse-ways of the grassy steppes. It was, at any rate during its last millenia, the Age of *Philosophies*, when man pondered the better way of life, as opposed to a mere struggle for existence or for personal power.

The Fourth Age was that of *Nationalism* which began about A.D. 400 in Europe (to which our attention is chiefly confined), and lasted

about 1,200 years. It was marked by a vast clearing of the forests, and by the impact of different cultural groups whose manners and languages had changed (largely owing to physical isolation) so that nations developed, with rival claims to the bounties of nature.

The Fourth Age was the age of *Over-Sea Conquest*, and was marked by the great sea-borne migrations which commenced about 1600. As stated in earlier sections, Columbus started a complication of the distributions of man; which leads us to separate the pre-Columbian times with relatively simple patterns, from the post-Columbian times with races and cultures, at first glance, hopelessly mixed. This age lasted about 250 years.

The Fifth Age was that of the *Industrial Revolution* which began early in the nineteenth century, but was not at all widespread until about 1850. It was marked by the dominance of those peoples who were lucky enough to have abundant coal resources. It was accompanied by the tremendous development of railways and city life; and by the necessary parallel development of food supplies from distant lands, which were exchanged for the industrial products of the coal-endowed nations.

The Sixth Age is the age of *Scientific Explanation* of man's environment, industries and psychology. It is a period of vast material evolution, based in large part on the widespread use of electricity and petroleum, both gifts of nature, and by no means spread haphazardly over the surface of the earth. It has unfortunately been largely an age of world war, based on the overcrowding of the world for the first time.

The Seventh Age is the one which we are just entering; these last three ages necessarily exhibit considerable overlap. It will be the age of aviation, the conquest of the tropics by central cooling, of electronics and atomic power. It is the age of the New Deal, and of widespread attempts to relieve social injustice, with the most striking developments taking place in new lands like New Zealand, the United States and the U.S.S.R. We hope that it will be the *Age of Internationalism*; of a growth of man beyond the petty selfish ideas of a juvenile Nationalism, which is however a natural but outmoded phase of the pageant of civilization.

The writer believes—as Bernstein and others have suggested—that the material basis of life, the manner in which life and its requirements are produced, determines in the last instance the social ideas and

institutions of any particular historical epoch; so that fundamental changes in the former also produce in the long run fundamental changes in the latter. In the present volume the writer is not concerned with the political and social results, so much as with changes in the material bases of life. The interplay of these two elements—environment and man's response—is the method by which civilization has developed.

Man, like every other living creature, is a parasite on the surface of the earth, depending entirely on the distribution of the gifts of Mother Nature. There seems to be a logical plan, whereby these gifts may be more and more fully utilized as man educates himself to appreciate them. He usually finds the best plan by a wasteful and lengthy process of hit-or-miss experiments. It should be the proud privilege of the geographer to see that the best plan for a given environment, and for a given stage of human utilization of the same, should be adopted without so much lost effort.

The relation between the environment, i.e., the bounties of nature, and the way in which man uses them, may be illustrated by an analogy which should be clear to the reader. Man is like the traffic controller in a large city, who alters the rate, but not the direction of progress. So also man is able to accelerate, slow or stop the progress of a country's development. But he should not, if he is wise, depart from the directions as indicated by the natural environment. Thus the phrase *stop-and-go determinism* seems to epitomize the ideas which form the basis of the writer's geographical philosophy.

The chief aim of civilization, as I see it, is not to prepare for a better world beyond this earth, but to prepare a better world on this earth. Our immediate objective should be a world at peace. This can only be attained by studying world problems, especially those involving other nations and regions. This is indeed the province of the modern geographer, especially if he gives considerable attention to the new department of Cultural Geography.

I have finished my brief study of the pageant of civilization, and it may be that I have too completely ignored some phases of human development. But geography deals essentially with material aspects of our life, though as I stated on an early page it seems to me to act as a liaison subject between science and philosophy. Some of the higher attributes of human philosophy, such as forethought and forbearance, seem to be inculcated by a study of cultural geography. If we adopt

as our own the ruling principle of Greek education, "to train youth to deal intelligently with existing conditions," then I know no better foundation for those further necessary disciplines which are included in the general term of the philosophical sciences.

"Geopacifism" is an attempt to base the teachings of freedom and humanity upon real geographical deductions; adopting Weigert's phrase, (which was used in another connection) it is *humanized geopolitics*. It shows, for instance, from a study of the World Plan, where the leading nations must arise; be it understood to lead not to conquer. It shows how the conflicts based on racial differences are usually absurd. There is no "yellow race" and no "white race," so that there cannot be biological conflicts between them. It tries to understand the evolution of the Jewish folk, as the best answer to the poison of anti-Semitism. It describes the widespread race-mixing in Europe. It explains the realities of climatology, with a view to aiding the world to improve the *better* portions of the world first; instead of encouraging wasted efforts whereby folk are urged to develop difficult terrains, when easier lands are available near at hand. It shows that we should study environmental control so as to advance in harmony with our environment. It is a material philosophy, but not a complete one, because it does not pretend to discuss those basic principles which properly belong to distinct *ethical* disciplines.



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